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PMI | Africa IRS (AIRS) Project

Indoor Residual Spraying (IRS 2) Task Order Four

ETHIOPIA
END OF SPRAY
OPERATIONS REPORT
2013

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ETHIOPIA
END OF SPRAY OPERATIONS REPORT
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ACRONYMS

AIRS	Africa Indoor Residual Spraying
CB IRS	Community-based IRS
DB IRS	District-based IRS
DCV	Data Collection Verification
DDT	Dichlorodiphenyltrichloroethane
DEV	Data Entry Verification
EC	Environmental Compliance
ECO	Environmental Compliance Officer
EE	Error Eliminator
FMOH	Federal Ministry of Health
HEW	Health Extension Worker
HLC	Human Landing Catch
IEC	Information, Education and Communication
IHS	Imperial Health Sciences
IRS	Indoor Residual Spraying
IT	Information Technology
M&E	Monitoring and Evaluation
MFP	Malaria Focal Person
ORHB	Oromia Regional Health Bureau
PMI	President's Malaria Initiative
PPE	Personal Protective Equipment
PSC	Pyrethrum Spray Collection
PSECA	Pre-season Environmental Compliance Assessment
RTI	Research Triangle Institute International
SBCC	Social Behavioral Change Communication
SL	Squad Leader
SOP	Spray Operator
TL	Team Leader
TOT	Training of Trainers
USAID	United States Agency for International Development
USG	U.S. Government

EXECUTIVE SUMMARY

The President's Malaria Initiative (PMI) has been supporting indoor residual spraying (IRS) in Ethiopia since 2008. In August 2011, Abt Associates was awarded a three-year Africa-wide Indoor Residual Spraying project (AIRS), IRS 2 Task Order 4, funded by USAID under PMI. In 2013, the second year of AIRS operations in Ethiopia, the key objectives of the program were to contribute to the reduction of malaria-associated morbidity and mortality by:

- Implementing IRS in 36 districts of the Oromia region;
- Providing technical and logistic support to IRS in 24 PMI-graduated districts in the Oromia region; and
- Building capacity of the national malaria program.

The IRS operation in Ethiopia was implemented between August 15 and September 27, 2013, in all 36 project districts. Bendiocarb, an insecticide from the carbamate class was used for the IRS operation in all districts. In 30 districts, the district health office, with technical and logistic support from AIRS, was responsible for implementing all planning, training, spraying and ensuring environmental compliance activities. This model is referred to as district-based indoor residual spraying (DB IRS) in this report. In six other districts, the responsibility for training spray operators (SOPs) and for planning and implementing the spray operation was decentralized to the village level and specifically to health extension workers (HEWs). HEWs were also put in charge of ensuring environmental compliance during spray operations. This model is referred as community-based IRS (CB IRS) in this report. The district and AIRS Ethiopia provided supportive supervision in both models. The project also provided technical and logistics support to 24 districts that graduated from PMI support in 2011.

Table 1 shows the main achievements of AIRS Ethiopia during the spray campaign in 2013.

TABLE 1. MAIN 2013 IRS RESULTS

Number of provinces/districts covered by PMI-supported IRS	36 districts in the Oromia region
Number of structures targeted by PMI-supported IRS (during work planning)	550,000
Number of structures found by SOPs	638,173
Number of structures sprayed by PMI-supported IRS	635,528
2013 spray coverage	99.6%
Population protected by PMI-supported IRS	Total population – 1,629,958 Children under 5 – 240,558 Pregnant women – 25,211
Dates of PMI-supported IRS campaign	Aug 15–Sep 27, 2013
Length of campaign	37 days
Number of people trained with USG funds to deliver IRS	2,684

Note: USG=U.S. Government

As part of spray campaign, the project conducted comprehensive tests on spray quality and insecticide resistance using wild and susceptible mosquitoes. These entomological results include the following:

- Mortality of wild and susceptible mosquitoes was 99–100 percent in all eight (six community based and two district based IRS) tested sites 1–3 days post spray.
- Susceptibility of the main vector to 8–9 World Health Organization-approved IRS insecticides was tested in 4 of the 5 sentinel sites. The vector is susceptible to pirimiphos methyl, fenitrothion, propoxur and bendiocarb and resistant to DDT and most of the pyrethroids.
- The project monitored residual efficacy of bendiocarb and propoxur sprayed in experimental huts with different type walls between April and September 2013. The residual life of the carbamates was much longer on painted surfaces than on mud and dung coated walls.

Some Challenges and Lessons Learned

AIRS Ethiopia dealt with several challenges in making the above achievements. These challenges, and lessons learned that will be applied to future spray rounds, include the following:

- Project districts are highly scattered across the Oromia region and located far away from the AIRS office, which poses a challenge for the AIRS team to ensure technical assistance to all districts and high quality supervision and coordination in districts assigned to each team member. To address the challenge, the project is proposing recruitment of 4-6 zonal coordinators to help with the supervision of the operation and training activities.
- Due to heavy rains and bad roads, it was very difficult to access a few operational sites. To deliver IRS supplies the project used farming tractors and animals and some districts were forced to work from one operation site. Hopefully, the roads will get better as many of them are under construction by the government. Otherwise, the project will continue utilizing all possible means of transportation to support the spraying.
- Competing priorities of the district health offices delayed SOP training and the start of spray operations in some districts, particularly in the CB IRS districts where the HEWs were assigned different tasks at the time of the start of spray campaign. The issue was discussed with the management of the district health offices and agreement was reached to avoid conflicting schedules during the IRS operation.
- Some SOPs still complained about the boot size; however, there were significantly fewer complaints this year than last. In preparation for the next spray campaign, AIRS Ethiopia has collected shoe size from the 2013 seasonal personnel to estimate the size breakdown and will plan the procurement based on this information. This should partly resolve the problem.
- Network connectivity was a frequent problem in several districts, which slowed down transfer of the spray data to the AIRS office. Transport was provided to data entry clerks to travel to a nearest town for better internet connection to transmit data.
- A large order for internationally procured items arrived late and caused delays with distribution from the central store to districts. To avoid the delays, the team established a detailed procurement and shipment plan with significant lead time for each step of the process.
- Storage spaces at the community health posts in CB IRS districts did not meet required size standard but due to lack of other available space, the project used them for storing IRS materials during the spray period. All items were returned back to the district stores at the end of the spray operation. If PMI carries on CB IRS in 2014, the project will continue utilizing the existing space in the health posts for temporary storage and reinforce the importance of keeping the space in

compliance with safety and security standards during the trainings. The Government of Ethiopia is currently supporting construction of mini stores through the Global Fund grant but not to the PMI districts.

1. INTRODUCTION

In August 2011, Abt Associates was awarded a three-year Africa-wide Indoor Residual Spraying project (AIRS), IRS 2 Task Order 4, funded by USAID under the President's Malaria Initiative (PMI). The mandate of the project is to limit exposure to malaria and reduce the incidence and prevalence of malaria in up to 17 countries in sub-Saharan Africa through the implementation of indoor residual spraying (IRS) programs.

1.1 PROJECT OBJECTIVES IN 2013

The major objective of the AIRS Ethiopia project is to contribute to the national and PMI goals of reduction in malaria morbidity and mortality in Ethiopia through the implementation of quality IRS in selected districts of Oromia region.

In 2013, AIRS Ethiopia had the following specific objectives:

- Spray up to 550,000 structures in 36 districts and provide technical support to IRS operations in 24 graduated districts (up to 512,357 structures) of Oromia;
- Reach a minimum coverage of 85 percent of the structures found in targeted villages by implementing high-quality IRS operations;
- Build capacity at the national, regional state, district, and local levels to manage IRS operations, including planning, spraying, resource allocation, and monitoring and evaluation (M&E); and
- Monitor the impact of IRS operations on selected entomological and disease indicators.

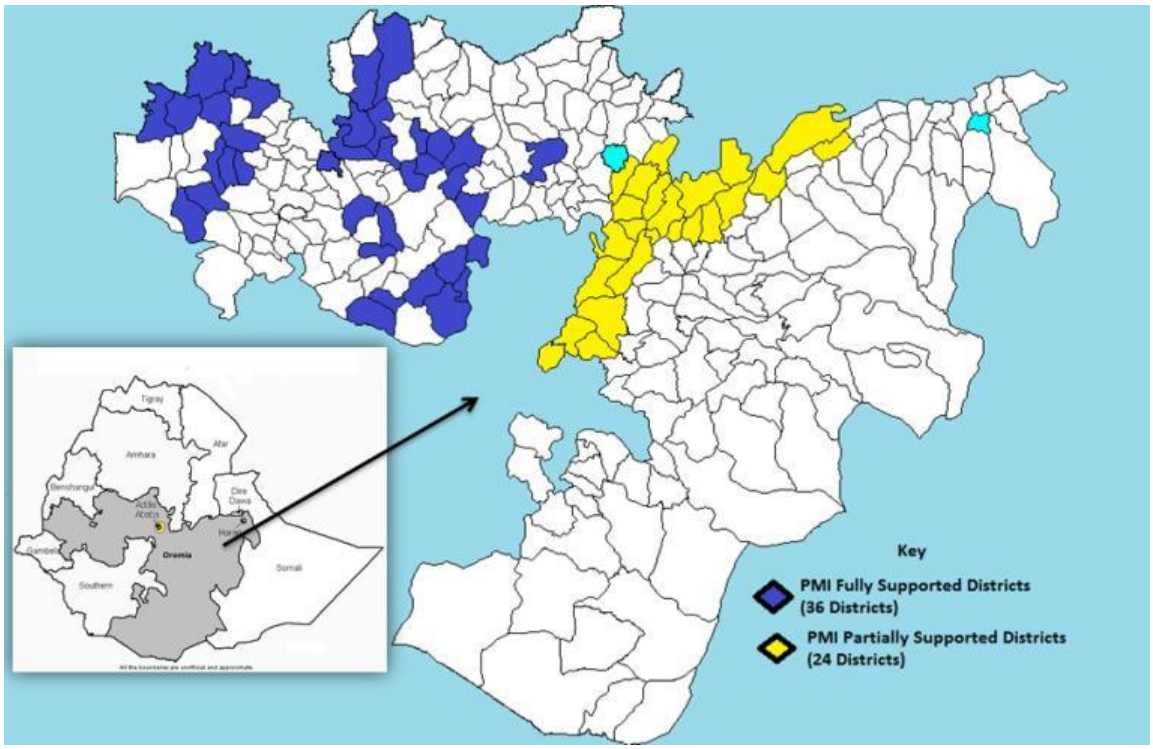
In addition to implementing the IRS campaign, AIRS Ethiopia aimed to carry out the following activities:

- Organize and conduct national-level comprehensive workshops for Federal Ministry of Health (FMOH), Regional Health Bureaus, zonal/district health offices, and Dire-Dawa city council staff to strengthen the capacity of planning, implementation, and M&E of IRS operations;
- Support entomological training to enhance national capacity in conducting insecticide resistance studies, tracking residual life of insecticides, and properly monitoring vector densities, species composition, and behavior;
- Conduct insecticide resistance studies, wall bioassay, vector density, and behavioral studies to generate adequate data to guide insecticide selection for IRS, monitor if insecticide pressure will force mosquitoes to change or modify their behavior, assess the quality of spraying, and determine the residual life of different insecticides in the country context; and
- Coordinate the process of disposing expired dichlorodiphenyltrichloroethane (DDT) from 43 PMI districts and assist the FMOH with a plan to dispose obsolete insecticides, primarily DDT and malathion.

1.2 SPRAY SITES

The AIRS Ethiopia project is carried out in collaboration with the FMOH, the Oromia Regional Health Bureau (ORHB), and other implementing partners in Oromia regional government. The largest region by surface area and population in Ethiopia, Oromia also has the highest malaria prevalence in the country. The 2013 PMI-supported districts are all located in western and southwestern areas of the region, as shown in Figure 1.

FIGURE 1. MAP OF PMI FULLY AND PARTIALLY SUPPORTED DISTRICTS



PMI and the ORHB conducted a series of consultative meetings discussing the incidence of malaria, history of spray, altitude, and other epidemiological factors to make an informed decision about the districts that required full IRS support. The same 36 districts in six zones that were covered last year received full PMI support during the 2013 IRS operation. Table 2 shows numbers of districts by zone.

TABLE 2. NUMBERS OF PMI FULLY SUPPORTED DISTRICTS BY ZONE

Zone	East Wollega	West Wollega	Illu Aba Bora	Jimma	Kellem	West Shoa	Total
Districts	9	7	4	6	5	5	36

1.3 INSECTICIDE SELECTION

In 2012, AIRS Ethiopia tested the main malaria vector, *An. gambiae s.l*, for susceptibility to 11 insecticides in the five permanent national sentinel sites. The results (Table 3) showed that according to the WHO classification, the vector was fully or moderately susceptible to pirimiphos methyl, fenitrothion, propoxur and bendiocarb in all study sites. It was highly resistant to DDT. Moreover, the vector was resistant to all the pyrethroids tested for including etofenoprox, a new pyrethroid derivative.

TABLE 3. SUMMARY OF 2012 INSECTICIDE RESISTANCE TESTS

Insecticide	Districts				
	Asendabo	**Halaba**	**Zway**	**Chewaka**	**Bahrdar**
	Mortality %				
Permethrin	10.9 (110)	-	-	-	-
Propoxur	98.1(105)	99 (100)	100 (100)	96 (100)	100 (100)
Malathion	66.1 (115)	48 (100)	90(100)	58(100)	26 (100)
Lambdacyhalothrin	25.7 (105)	-	-	-	-
Fenitrothion	99.1 (105)	100 (100)	99100)	100 (100)	100 (100)
Etofenoprox	8.7 (115)	-	-	-	23 (112)
DDT	3.8 (103)	0 (100)	13(100)	3 (100)	6 (100)
Bendiocarb	93.3 (105)	98 (100)	100(100)	90 (100)	87 (100)
Deltamethrin	12.8 (115)	1(100)	27 (100)	12 (100)	44 (100)
Alphacypermethrin	24.8 (105)	-	-	-	50 (120)
Pirimiphos methyl	100 (105)	-	-	-	100 (100)

In addition, the AIRS team conducted susceptibility tests with bendiocarb, deltamethrin, propoxur and fenitrothion in six project sites. These tests were completed to assess the susceptibility of the vector to the insecticide sprayed during the 2012 operation and recommend a type of insecticide for 2013 IRS. Similar to the results in the national sentinel sites, the vector in the project sites was resistant to deltamethrin and fully or moderately susceptible to bendiocarb, propoxur and fenitrothion as shown in Table 4.

TABLE 4. SUMMARY OF 2012 SUSCEPTIBILITY TESTS IN PROJECT DISTRICTS

Insecticide	Region	Zone	Districts	**Area**	**% mortality**
Bendiocarb	Oromia	East Wollega	Gobu Sayo	Gambella Tere	100 (75/75)
		West Shoa	Ilu Gelan	Siba Biche	97.3 (146/150)
		Jimma	Omo Nada	Asendabo	95 (95/100)
Deltamethrin	Oromia	East Wollega	Gida Ayana	Gutin	42 (84/200)
		West Wollega	Njeo	Njeo Town	61 (61/100)
		Jimma	Omo Nada	Asendabo	8 (8/100)
		East Wollega	Gobu Sayo	Gambella Tere	16 (16/100)
		West Shoa	Ilu Gelan	Siba Biche	11 (11/100)
		Kellem Wollega	Dale Sedi	Aweitu-Gendosa	52 (52/100)
Propoxur	Oromia	East Wollega	Gida Ayana	Gutin	100 (100/100)
		Kellem Wollega	Dale Sedi	Aweitu-Gendosa	100 (100/100)
		Jimma	Omo Nada	Asendabo	100 (100/100)
		East Wollega	Gobu Sayo	Gambella Tere	100 (100/100)
		West Shoa	Ilu Gelan	Siba Biche	98 (98/100)
		West Wollega	Nejo	Nejo Town	100 (100/100)
Fenitrothion	Oromia	Kellem Wollega	Dale Sedi	Aweitu-Gendosa	98 (98/100)
		East Wollega	Gobu Sayo	Gambella Tere	100 (100/100)
		West Shoa	Ilu Gelan	Siba Biche	100 (100/00)

Based on the 2012 findings, FMOH sprayed bendiocarb and propoxur in all its IRS targeted districts in 2013. AIRS Ethiopia used bendiocarb for the spray operations in the 36 districts.

AIRS also provided 600 boxes (72,000 sachets) of bendiocarb to FMOH to make sure spraying will be competed in the 24 graduated districts.

1.4 TECHNICAL SUPPORT TO THE FMOH

As a member of the Malaria Control Support Team and Technical Advisory Committee to the National Malaria Control Program, AIRS Ethiopia is contributing to the development of a new malaria national strategic plan (2014–2020) and insecticide resistance management strategy. AIRS Ethiopia also contributed to the discussion of the vector control working group and the write-up of the vector control component of the strategic plan and the document on insecticide resistance management strategy. AIRS Ethiopia has so far attended all the meetings of the vector control working group and remains continuously engaged in the process.

2. Pre-Spray Activities

2.1 Comprehensive IRS training and Planning

The project held in July a regional comprehensive IRS training that included operational planning of 2013 IRS campaign with health personnel from selected districts and Oromia zonal and regional health offices. A total of 224 staff participated in round one and round two meetings conducted in Nekemte and Jimma respectively. The Nekemte session was for participants from the three zones of East Wollega, West Wollega, and West Shoa, and the Jimma session was for participants from Jimma, Ilu Aba Bora, and Kellem Wollega zones. During the meeting, participants developed detailed action plans including supervision visits and a calendar for the spraying. They also agreed on the logistics, transportation requirements, type and number of spray actors to be involved, and the mechanism that would be used for capacity building.

2.2 Logistics Needs Assessment and Procurement

AIRS Ethiopia conducted a logistics needs assessment at the end of the 2012 spray operation in October 2012 and the findings were discussed with representatives from all targeted districts. The assessment included review of the current stock of equipment, personal protective equipment (PPE), and insecticides. As part of the review, the participants analyzed conditions and availability of soak pits and storage facilities at the district level.

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 needed for the IRS activities.

Most of the PPE and spray pumps used during the 2012 IRS campaign remained in good condition and were available for use in the districts operated on the district-based IRS (DB IRS) model in 2013. The project procured additional equipment and spray materials to ensure that SOPs for the community-based IRS (CB IRS) districts have all required PPE and supplies. AIRS Ethiopia also noted the quantities of damaged or non-reusable PPE, and developed a list of PPE that AIRS needed to procure.

Overall, AIRS Ethiopia made local and international procurements using an open tender process and collecting bids/quotes on commodities to be purchased. A full list of all PPE and materials procured for the 2013 IRS campaign is found in Table A-1in Annex A.

The team also established the number and type of vehicles required for each district's IRS operations based on number of structures per district and the topography of the areas. AIRS Ethiopia conducted a competitive bidding process to acquire vehicles and selected three local companies to supply the transportation.

2.3 Human Resource Requirements

AIRS Ethiopia used the number of sprayed structures in 2012 and estimates of structures in villages added this year to calculate the number of seasonal workers needed for 2013. At the recommendation of the regional, zonal, and district health offices, and last year's malaria incidence reports, AIRS Ethiopia accepted the request to spray 13 additional villages in five districts. The district stakeholders also agreed that, in accordance with previous IRS Ethiopia campaigns, that the team leaders (TLs) and squad leaders (SLs), supervisors, and organizers would be recruited from among health professionals working in the project-targeted districts and zones. In districts with a shortage of district health staff, agreement was

reached to recruit unemployed high school or higher-education graduates from the same districts. Based on this, all districts identified their TLs, SLs, and other spray actors based on each person's capacity and their interest to participate in the IRS operation.

2.4 TRAINING

AIRS Ethiopia is committed to building the capacity of national, regional and district staffs to implement, monitor, and evaluate quality spray operations. As part of this commitment, AIRS is striving to develop a cadre of well-trained SOPs who are technically proficient in insecticide application techniques, and are able to communicate effectively with beneficiaries in the communities and follow environmental compliance (EC) procedures. Similar to last year's practice, AIRS Ethiopia invited the FMOH to send SOPs from all regions in the country for training in comprehensive IRS, spray pump maintenance, and pesticide poison management. However, the FMOH communicated to AIRS its recent decision that national trainings are not encouraged unless they are to be cascaded to the district and community level. As AIRS Ethiopia had no plans and budget to cascade all national trainings to those levels, the regular schedule of national trainings implemented in the past was canceled. In 2013, the only national-level training held was the training of trainers (TOT) on enhanced entomological field training for regional experts.

The project conducted regional comprehensive IRS TOTs for the zonal and district staff in July. The TOT participants then recruited and conducted a six-day training for SOPs, reserve SOPs (porters), and SLs at the district level. The TOT participants also oriented the health extension workers (HEWs), washers, storekeeper assistants, and guards on issues related to spray operation, mobilization, EC, and safety and security. Orientation was provided for drivers at the central level. AIRS Ethiopia also trained professionals from health facilities in the IRS target districts on pesticide poison management. Additionally, the AIRS M&E team trained 40 data entry clerks (DECs) and employed 36 of them with the remaining four kept in reserve in case replacements were needed. Table 5 provides a breakdown of trainings, and types, sex, and number of participants.

TABLE 5. ETHIOPIA 2013 IRS TRAINING PARTICIPANT DATA, 36 DISTRICTS

No	Trainings	Participants	# Trained		
			Male	Female	TOTAL
A. National Level					
1	TOT on enhanced entomological field training for regional experts.	Entomologists from regions	27	2	29
B. Regional Level					
2	TOT comprehensive IRS - Regional	MFPs, SBCC, and EC supervisors	214	10	224
3	DECs	Data tech from project zones	34	6	40
4	Insecticide poison management	Clinicians from district health facilities	85	18	103
5	TOT on spray pump use and maintenance	Vector control expert from regions	35	9	44
C. District Level					
6	Spraying operations, mobilization and EC				
	• SBCC, mobilization and enumeration	Health extension workers	26	693	719
	• Spray operation and communication	*SLs*	254	238	492
	• Spray operation and communication	*SOPs*	1,490	2	1,492

No	Trainings	Participants	# Trained		
			Male	Female	TOTAL
	• Spray operation and communication	*Porters*	361	12	373
	• Washing and environmental compliance	*Washers*	0	71	71
	• Transport safety	*Drivers*	136	0	136
	• Fire safety and operation site security	*Guards*	192	0	192
	• EC, stock management and fire safety	*Storekeepers*	33	3	36
	• EC, stock management and fire safety	*Storekeeper's assistances*	28	8	36
Total			**2,915**	**1,072**	**3,987**

Note: MFP=malaria focal person, SBCC=social behavioral change communication

The highlighted rows in Table 3 are the trainings that are counted under the PMI indicator "Number of people trained with USG funds to deliver IRS." Table 6 presents these figures disaggregated by IRS delivery TOT, spray operations training, and clinical training.

TABLE 6. ETHIOPIA 2013 DATA FOR PMI INDICATOR "NUMBER OF PEOPLE TRAINED WITH USG FUNDS TO DELIVER IRS"

Type of Training	Males	Females	Total
IRS delivery TOT	214	10	224
Spray operations	2,105	252	2,357
Clinical	85	18	103
Total	**2,404**	**280**	**2,684**

2.5 Assistance to 24 Graduated Districts

In April 2013, AIRS Ethiopia arranged a two-day micro planning meeting for district MFPs, district health managers, zonal MFPs, and zonal health office heads. As shown in Table 7, 57 health staff and managers from 24 graduated districts and five zonal health offices attended the micro planning meeting.

The objective of this meeting was to:

- Identify areas for 2013 spray operation based on morbidity data from last year;
- Estimate the number of unit structures to be sprayed;
- Identify gap in resources that AIRS Ethiopia can support; and
- Identify gaps for technical support by AIRS Ethiopia.

At the planning meetings the following key factors were identified:

- 528 kebeles[1] required IRS in 2013;
- 587,306 unit structures to spray, and
- 2,015,613 people to be protected ;

[1] A kebele is the smallest administrative unit in Ethiopia; it comprises approximately 1,000 households.

- AIRS Ethiopia to replace non-functional spray pumps and PPE;
- AIRS to provide technical guidance on EC.

Following the micro planning workshop, AIRS Ethiopia organized training on EC for 55 staff from the 24 districts, five zonal health offices and the ORHB. The three-day training, held in Adama in June, covered topics including importance of EC assessment, workers and residents' health and safety; insecticide storage, transportation, and tracking; effluent waste management and solid waste management, etc.

TABLE 7. TRAINING PARTICIPANTS FROM GRADUATED DISTRICTS

Type of Meeting/Training	Participants Coming from	Participants, by Job Title	No. Trained		
			Female	Male	Total
Micro planning	Districts	**Total**	**8**	**49**	**57**
		District MFPs	4	20	24
		District health office managers	4	20	24
	Zones	Zonal MFPs	0	5	5
		Zone health office managers	0	4	4
Environmental compliance	Districts	**Total**	**8**	**47**	**55**
		District MFPs	3	21	24
		District environmental health officers	5	19	24
	Zones	Zonal MFPs	0	4	4
	Region	Region malaria experts	0	3	3

Logistics support: Based on the gaps identified during the graduated districts assessment, AIRS Ethiopia provided logistics that included spray pumps, pump spare parts, and PPE as indicated in Annex A. In addition the project also supported the IRS operation of these districts with 600 boxes (72,000 sachets) of bendiocarb (Ficam).

Supportive supervision: AIRS conducted supportive supervision of the graduated districts during the IRS campaign to make sure that the required EC activities are applied. The AIRS Spray Operations Coordinator supervised the four districts that received bendiocarb from PMI and visited seven sites in total. Some of the districts visited applied CB IRS model with soak pits constructed by the government and community participation in each kebele. While the spray teams strictly used these soak pits for liquid waste disposal, problems were observed with daily washing of coveralls in one district due shortage of water. Coveralls were washed once a week. The districts in West Arsi Zone were using the soak pits constructed by PMI properly and the following is summary of the assessment by the AIRS Spray Operations coordinator:

Strengths:

- SOPs used their PPE properly and take bath daily.
- SOPs demonstrated good knowledge of procedures.
- SOPs accurately communicated post spray message to the households.
- SOPs and team leaders properly recorded and summarized the data in their respective data tracking forms.

- Daily output of SOPs was above average.
- Districts health offices displayed properly and regularly updated the performance tracking sheets introduced by the AIRS project.
- SOPs used soak pits and triple rinse process correctly.
- Coveralls used were washed daily in most districts.

Weakness

- Spray card is not available.
- Thermometers are located in the district store but temperature is not recorded regularly.
- Need for maintenance of some soak pits and wash areas because of weak fencing.
- Shortage of transportation to move SOPs from operation sites to villages and back. Often, the SOPs had to walk long distances.

The focus of the visit was the to see the districts' EC practice and the assessment showed that the EC activities of the graduated districts in West Aris Zone were satisfactory while the practice in the districts in West Hararge required some improvement.

3. COMMUNICATION

The primary objective of the AIRS Ethiopia communication activities was to ensure successful spray rounds by motivating near-universal coverage, timely vacating of premises, avoidance of re-plastering of sprayed walls during the peak malaria season, and adherence to safety precautions.

Because IRS has been practiced in Ethiopia on a national scale and for more than five decades, acceptance of IRS is high and the majority of the population is very familiar with the safety requirements and procedures of IRS. Thus, AIRS Ethiopia used mass media and community outreach approaches as a communication strategy during the 2013 spray operation. The project engaged all female HEWs in the 36 project districts as mobilizers during the communication campaign. HEWs received a one-day orientation on how to conduct community outreach and on specific IRS messages that need to be delivered to beneficiaries in their respective districts. HEWs then used their training to sensitize people during community meetings, and in churches, mosques, and schools.

Key IRS messages for 30-second radio spots were produced in collaboration with the ORHB communication department. The IRS-specific messages were recorded in two local languages: Oromiffa and Amharic. AIRS Ethiopia aired a total of 80 radio spots (40 in each of the two languages) starting two weeks prior to the IRS operation and during the spray campaign. This approach reduced the cost for mobilization by almost 50% compared to 2012.

The high IRS acceptance/coverage in the targeted communities indicated these communication approaches are productive. Additionally, AIRS Ethiopia evaluated effectiveness of mass media in five randomly selected districts. Ninety-five household heads (35 female and 60 male) responded to the questionnaire on the IRS mass media campaign. About half of the households reported owning a radio and listening to the radio daily or occasionally. Thirty-one (32.5 percent) of the respondents received the IRS messages from the radio; 57 (60 percent) heard about the spray campaign from social gatherings and directly from the HEWs. When asked their preference, 64.2 percent of respondents preferred community meeting for future communication.

As a member of the national malaria support team, AIRS Ethiopia marked World Malaria Day, which is held annually on April 25. The FMOH selected Kersa, a PMI-supported district, as a main location for the national celebration of World Malaria Day 2013. Because the district was the first PMI district to pilot CB IRS, AIRS Ethiopia participated with presentations of its work on insecticide resistance monitoring and CB IRS, including poster displays. Hundreds of the participants also visited PMI spray operation sites. HEWs and district and AIRS Ethiopia staff were present at the event and explained the PMI work to all inquiring visitors.

4. Spray Activities

4.1 Spray Operations

In Ethiopia, PMI is implementing the IRS program in close collaboration with the government. In 2013, through AIRS, PMI 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. The FMOH through the zonal and district offices recruited all spray personnel (SOPs, TLs and SLs, mobilizers, coordinators, supervisors, storekeepers, etc.). The numbers of the spray operation teams shown in Table 8 were based on the number of structures found during last year's IRS campaign and the target number of structures provided by the government for the kebeles added to target areas in 2013.

TABLE 8. DISTRIBUTION OF SPRAY ACTORS BY DISTRICT, 2013 SPRAY OPERATION

District	TLs	Supervisors	SLs	SOPs	Porters	Washers	Security Guards	Drivers	Store Assistants
Gubu Sayo	1	4	6	24	6	2	2	3	1
Boneya Boshi	2	4	6	24	6	2	2	2	1
Wama Hagelo	2	4	9	36	9	2	2	3	1
Limu	2	4	6	24	6	2	2	3	1
Dega	1	4	5	22	5	1	1	2	1
Sasiga	CB IRS	4	16	36	9	0	9	1	1
Gida Ayana	2	4	10	42	10	3	2	4	1
Guto Gida	2	4	7	28	7	2	2	4	1
Wayu Tuka	2	4	9	34	9	2	2	4	1
Begi	2	4	9	36	9	3	3	5	1
Kondala	2	4	9	37	9	3	3	5	1
Babo Ganbel	2	4	9	36	9	3	3	4	1
Mana Sibu	CB IRS	7	50	100	25	0	26	1	1
Kiltu Kara	2	4	6	24	6	2	2	2	1
Nejo	2	4	10	40	10	3	3	4	1
Guliso	2	4	7	28	7	2	2	4	1
Bedele	1	4	5	20	5	1	1	2	1
Didesa	2	4	7	28	7	2	2	2	1
Borecha	2	4	10	40	10	3	3	3	1
Chewaka	CB IRS	7	56	112	28	0	29	1	1
Kersa	CB IRS	6	43	80	20	0	21	1	1
Sokoru	2	4	10	40	10	3	2	4	1
Seka	3	4	11	44	11	3	3	5	1

District	TLs	Supervisors	SLs	SOPs	Porters	Washers	Security Guards	Drivers	Store Assistants
Shebe	2	4	8	31	8	2	2	3	1
Omo Nada	4	4	16	64	16	4	4	6	1
Tiro Afeta	3	4	13	52	13	3	3	5	1
Hawa Gelan	CB IRS	6	44	88	22	0	23	1	1
Seyo	2	4	8	32	8	2	2	3	1
Dale Webera	3	4	10	40	10	3	3	5	1
Dale Sadi	2	4	7	28	7	2	2	4	1
Lalo Kile	2	4	8	30	8	2	2	4	1
Nonno	2	4	8	32	8	2	2	4	1
Dendi	2	4	7	28	7	2	2	4	1
Bako Tibe	CB IRS	5	28	56	14	0	15	1	1
Danno	2	4	8	32	8	2	2	4	1
Ilu Galan	3	4	11	44	11	3	3	5	1
Total	**63***	**155**	**492**	**1492**	**373**	**71**	**192**	**118**	**36**

*23 supervisors are trained and deployed in the CB IRS districts.

Spraying started on August 15, 2013, and ended on September 27, 2013. Not all districts started on the same day because some zonal and district administrations assigned health staff and HEWs to work on other tasks at the same time. The length of the spray campaign for each district is shown in Table B-1 of Annex B. The average number of operational days was 30.7. The project used two models of IRS campaign to deliver the service to the 36 project districts: DB IRS and CB IRS 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 sometimes a small temporary store. On a daily basis, MFPs and team leaders deployed the spray operation squads to the program-supported villages. One squad leader (a district health staff or high school graduate recruited as a temporary employee) had four SOPs and one porter under his/her command.

In all project sites, zonal and district MFPs are responsible for supervision of the daily IRS operations in their respective areas. The AIRS Ethiopia team provided the district and zonal health teams with the supervisory checklists to meet and ensure an objective assessment on spray quality, EC, stock management, and so forth. Through continuous supervision, zonal and district teams, AIRS Ethiopia, and AIRS home office staff observed some minor performance issues including the following:

1. Leaking from the pumps (mostly used by new SOPs);
2. Inconsistent use of filter cloth when pouring water into a pump;
3. Soil washed into the pits in two districts due to rains;
4. Mathematical errors during the data entry;
5. Errors in SOP form recording;
6. PPEs are not compliant with the standards (e.g., missing buttons on the coveralls); and
7. No tracking of damaged goods in the stock records.

Most errors were corrected immediately; others were rectified shortly after being detected.

To ensure close and consistent supervision of the campaign, AIRS Ethiopia assigned all technical staff to specific districts. Prior to the spray campaign, the AIRS team did internal "self-retraining" on all IRS processes, standards, and requirements so they would be ready to conduct comprehensive supervision when out in the field. Each component leader also provided a checklist for each area of supervision.

Each AIRS technical expert supervised 5–9 districts as shown in Table 9. As part of the supervision, they provided on-the-spot trainings, and took corrective actions for any problems encountered. They were also responsible for monitoring and adjustment of spray performance and EC in their respective districts. AIRS team closely worked with the government supervisors. As a result, the contribution from the supervisors at all levels was very valuable, particularly at the initial stage of the spray operations, to address problems promptly.

TABLE 9. EC ASSESSMENT AND SUPERVISION SCHEDULE

Supervisor	District	August			September			
		Week			Week			
		1&2	3	4	1	2	3	4
M&E manager	Limu	Pre EC assessment						
	Dega	Pre EC assessment						
	Sasiga	Pre EC assessment						
	Gida Ayana	Pre EC assessment						
	Guto Gida	Pre EC assessment						
	Wayu Tuka	Pre EC assessment						
Technical manager	Gubu Sayo	Pre EC assessment						
	Boneya Boshe	Pre EC assessment						
	Wama Hagelo	Pre EC assessment						
	Nonno	Pre EC assessment						
	Dendi	Pre EC assessment						
	Bako Tibe	Pre EC assessment						
	Danno	Pre EC assessment						
	Ilu Galan	Pre EC assessment						
Operations manager	Begi	Pre EC assessment						
	kondala	Pre EC assessment						
	Babo Gambel	Pre EC assessment						
	Mana Sibu	Pre EC assessment						
	Kiltu Kara	Pre EC assessment						
	Nejo	Pre EC assessment						
	Chewaka	Pre EC assessment						
Database manager	Bedele	Pre EC assessment						
	Didesa	Pre EC assessment						
	Borecha	Pre EC assessment						
	Kersa	Pre EC assessment						
	Sokoru	Pre EC assessment						
	Seka	Pre EC assessment						

Supervisor	District	August			September			
		Week			Week			
		1&2	3	4	1	2	3	4
	Shebe	Pre EC assessment						
	Omo Nada	Pre EC assessment						
	Tiro Afeta	Pre EC assessment						
Operation coordinator	Guliso	Pre EC assessment						
	Hawa gelan	Pre EC assessment						
	Seyo	Pre EC assessment						
	Dale Webera	Pre EC assessment						
	Dale Sadi	Pre EC assessment						
	Lalo Kile	Pre EC assessment						
Regional Health Bureau	All districts							
Zonal Health Bureau	All districts in zone							
District Health Bureau	All kebeles districts							
M&E team	All districts							
COP	All districts							

4.2 COMMUNITY-BASED IRS

AIRS Ethiopia in collaboration with PMI Ethiopia and the ORHB selected five additional districts for a total of six districts (including Kersa, where CB IRS was done in 2012) for implementation of the CB IRS model. One district from each of the six zones in Oromia in which the project has been operating was selected to pilot CB IRS.

The project did a seven-day district-level training to prepare HEWs in the six selected districts to serve as SLs. The districts had a total of 118 kebeles targeted for IRS. Most kebeles sent two HEWs to the training; three kebeles sent three HEWs and two sent only one HEW, for a total of 237 SL trainees. Twenty-four kebeles that had no HEWs available at the health post at the time of training sent one or two male health workers from a health center. The trained HEWs, in collaboration with their kebele leaders, then selected five literate community members (total 590) and trained them for six days on spray operations and communication. Four of the community members worked as SOPs and one served as porter or SOP replacement in their kebeles. Table 10 shows 2013 spray performance for each CB IRS district.

TABLE 10. SPRAY OPERATION PERFORMANCE IN CB IRS

Districts	Total # of Eligible Structures Found by SOPs	Total # of Eligible Structures Sprayed	% of Total Structures Sprayed	Population Protected	Pregnant Women Protected	Children Under 5 Protected
Kersa	26,761	26,587	99.3%	75,380	930	10,754
Chewaka	27,201	27,196	100.0%	77,979	1,913	13,443
Hawa Gelan	27,048	26,988	99.8%	67,226	1,518	11,102
Sasiga	14,923	14,892	99.8%	41,524	540	5,589

Districts	Total # of Eligible Structures Found by SOPs	Total # of Eligible Structures Sprayed	% of Total Structures Sprayed	Population Protected	Pregnant Women Protected	Children Under 5 Protected
Manasibu	28,444	28,386	99.8%	66,233	690	8,981
Bako Tibe	16,599	16,582	99.9%	44,795	370	5,370
Total	140,976	140,631	99.8%	373,137	5,961	55,239

The spray operation in the six CB IRS districts took an average of 22 working days. The district MFPs required only one vehicle per district to do logistics and spray supervision. Other district and health center supervisors used the district health office motorbikes for supervision and data collection. There was no need to deploy vehicles to support SOPs in the CB IRS model because they lived in nearby villages and went home at the end of each spray day. Before going home for the night, SOPs, porters and HEWs would remove their PPE and take a shower, preventing contamination when they went home. AIRS has undertaken a cost analysis of the CB IRS model that will be reported separately.

4.3 Logistics and Stock Management

For the 2013 campaign, AIRS Ethiopia rented one central warehouse and used two ORHB-owned stores that the project helped to rehabilitate. All are located about 30 km outside of Addis Ababa. In the rented warehouse, the project stored bendiocarb. In one ORHB-owned store, AIRS Ethiopia kept all non-insecticide IRS supplies and in the other, it collected insecticide-contaminated waste. Insecticides and IRS supplies are temporarily kept in these stores before being distributed to districts. All stores are managed by one full-time storekeeper hired by the project and regularly supervised by the logistics coordinator. AIRS Ethiopia received 40,008 kg (3,334 boxes or 400,080 sachets) of bendiocarb insecticide (Ficam) for the 2013 spray operation in 36 districts.

AIRS Ethiopia also rehabilitated district warehouses in all 36 operation sites. These warehouses belong to the district health offices. The storekeepers managing them are permanent of employees of the district health offices and receive per diem from the project for the duration of the spray campaign to handle the IRS inventory.

Prior to the campaign, AIRS Ethiopia dispatched required equipment and materials from the central warehouses to the district ones. For the PPE and equipment, the project used dispatching slips (notes) that were signed by the receiving stores as proof of delivery. Government vouchers with seal of the district health office were collected as a proof of receipt.

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. At the end of each spray day, porters or SLs would turn in the used (empty) and unused sachets to the TL, who returned them to the store. The storekeeper recorded the full sachets on the stock card, updated the balance, and returned the unused sachets to the full stock. Used sachets were recorded on the daily utilization record form that tracks each store's empty sachets 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.

During the operation, the storekeepers also documented daily minimum and maximum temperature records.

4.4 STOREKEEPER TRAINING

In preparation for the 2013 spray campaign, AIRS Ethiopia conducted training for district storekeepers with technical support from Imperial Health Sciences (IHS, previously known as RTT). Training was held July 8–11, 2013, in Nekemte. The IHS supply chain specialist co-facilitated the four-day training for 36 storekeepers. He developed and presented training modules on the following topics:

- FIFO (first-in/first-out) arrangement; FEFO (first-expire/first-out)
- Stock-card management
- Storage of insecticides and other IRS equipment
- Receipt of IRS waste from the field and storage
- Warehouse security

Practical sessions included:

- Store checklist
- Bin card completion
- Identification of equipment in the store
- Completion of "daily insecticide distribution and tracking card"
- Completion of "temporary goods dispatch and delivery note"
- Store management internal controls checklist

Participants completed practical exercises on how to record transactions in the stock ledger book. Below are examples of the various transactions studied:

- Opening stock
- Receipts
- Issuance of insecticides to spray team using requisition voucher
- Return of unused insecticides
- Return of empties/ waste cartons for proper disposal
- Inventory checks
- Adjustments for discrepancies

4.5 ENVIRONMENTAL COMPLIANCE

A supplemental environmental assessment for Ethiopia was carried out by an independent consultant in May 2013 and received USAID approval in August 2013. The assessment is valid for a period of five years from 2013-2017.

The project team made significant efforts to ensure compliance with environmental standards during the spraying round. AIRS Ethiopia conducted necessary trainings; refurbished and prepared for use IRS infrastructure such as soak pits and stores; procured PPE and materials; and organized regular site inspections by AIRS staff.

Soak pits/Effluent disposal: To ensure safe disposal of effluent waste, AIRS Ethiopia prepared a total of 181 (74 district size and 107 community size) soak pits. For efficiency in an effort of such scale, the

project used polyethylene plastic sheets as ground cover for the washing/rinsing areas of the soak pits. The project carried out maintenance activities in all the 92 soak pits (74 districts size and 18 community size) from last year and constructed additional 89 new community size soak pits for the five CB IRS districts.

Stores: There were 36 existing district stores. Project staff and government counterparts frequently inspected them for stock management and EC. The project equipped the stores with fire extinguishers, shelves, pallets, first aid kits, dust bins, emergency kits, and thermometers.

Pregnancy test: All females who work as SLs, SOPs, porters, storekeepers, and washers had pregnancy tests and were found fit to be involved in the operation to carry out their assigned duties.

No adverse events related to insecticide were reported in the 2013 spray campaign. A minor car accident occurred in Guliso district; no human injury was reported.

4.6 Environmental Compliance Inspections

AIRS Ethiopia conducted EC inspections in all 36 districts.

The project team conducted pre-spray operation inspections to check the preparedness of soak pits and stores for the campaign, ensure that accessibility to the sites is adequate, and observe any additional logistical needs to be addressed prior to the spray campaign. Five AIRS Ethiopia technical staff oriented on EC assessment performed all the pre-season EC inspection activities in the project districts. This is in addition to their specific tasks doing M&E, spray operation, and entomology work during the spray campaign. The project used a smartphone-based data collection system for performing pre-spray environmental assessments and inspections. Five AIRS staff used the smartphone to collect data.

One of the outputs from the smartphone-based pre-season environmental compliance assessments (PSECA) was an automatically generated work list for each storeroom/soak pit operational site, based on the responses given in the questionnaire. This work list was emailed to the technical staff and project management as soon as they uploaded a PSECA data record to the online cloud storage. The principal goal of this work list was for the field project staff to have the information about what needs to be done at each site in order to be ready for spray season. Action was taken to perform all tasks in the work list and green light to start operation received for all operation sites.

CB IRS soak pit, Bako dsitrict

During the mid-spray inspections, the same technical staff and other supervisors conducted checks to confirm compliance with environmental requirements. Six checklists were used during the mid-spray season, and they covered:

1. Storekeeper performance
2. Spray operator morning mobilization
3. Transport vehicle inspection
4. Spray operator performance
5. Homeowner preparation
6. End-of-day clean-up

The AIRS staff completed checklists 1, 2, and/or 3 at the morning inspection to check that the spray personnel use PPE properly. They also observed vehicles and storekeepers to ensure proper insecticide tracking, and collection of the IRS-generated waste. Later in the day,

they used checklists 4 and 5 to check on SOP technique and homeowner preparation and ensure that residents were safe from the insecticide application and that proper technical procedures had been followed in the preparation of the house and application of the insecticide. Finally, they visited operational sites at the end of the day to observe clean-up activities using checklist 6. The inspections focused on securing a clean, uncontaminated environment around the soak pits and protecting the area from community access. The AIRS staff assessed the sites to ensure that all PPE and other IRS logistics were properly washed, collected, and stored with proper inventory records for the next period of operation. Most of the corrections were done on the spot and discussed during the post spray conference. Lessons learned will be incorporated during the next year planning and training.

Overall, the inspections revealed the EC requirements are satisfactorily met, with few exceptions that will be improved in the future. During the evaluations, certain issues/points came up that are not clearly manifested in the Best Management Practices Manual. Spraying the outer part of a door and the eaves of houses was implemented according to the national guideline. SOPs were encouraged to not carry leftover insecticides and not to use leftover spray solution the next day. One point requiring discussion is the issue of shutting all doors and windows during the spraying of the indoor walls of houses. It may not be technically advisable to ask SOPs to hold a flashlight in one hand and spray with the other hand because this may compromise the quality of operation. The other options are to slightly open the door while spraying inside or provide the SOPs with more powerful lamps or helmet-mounted flashlights. AIRS Ethiopia recommends following the national guidelines to slightly open the doors during indoor spraying to allow light into the rooms. Therefore, there is a need to reconsider, approve, and include this point in the Best Management Practices Manual.

Use of PPE: An adequate supply of PPE has been provided to spray actors who handle pesticides: SOPs, porters, storekeepers, washers, and others. Use of PPE was satisfactory except for the chronic problem of improperly fitting boots. However, there were fewer complaints about boot size this year than last.

Solid Waste Collection and Disposal: Non-DDT-contaminated IRS-generated solid wastes such as empty sachets, used masks, and contaminated boxes were collected and stored in district stores from where the project transported them for final disposal through incineration at a central location. AIRS Ethiopia is using two incinerators to dispose of all non-DDT contaminated solid waste collected after the spray and is planning to complete the incineration in the next 2-3 months.

Capacity Building/Training: EC training was given during the TOTs for district, zone, and regional staff.

4.7 DECOMMISSIONING OF DDT EVAPORATION TANKS

Due to health problems, the AIRS Ethiopia ECO was on medical leave for about 5 months. Therefore, the project postponed activities related to the decommissioning of the DDT evaporation tanks in five graduated districts. The project will work on the decommissioning task in the next year as it included in the 2014 work plan.

5. Post-Spray Activities

5.1 Closing of IRS Operations

Due to large volume of activities during post spray period, AIRS Ethiopia will hold the end-of-spray meeting with district, zone, and region-level stakeholders at the end of November.

5.2 Demobilization 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. Post-spray inventory of all IRS-related materials was completed by the end of October. The inventory results showed that all non-consumable IRS equipment and materials were returned from operation sites; no loss or damage was reported. It is important to note that after the materials are dispatched to the districts, they are considered to be government property and, therefore, are recorded and documented by the district health offices. The storekeepers are responsible for dispatch and collection of the items after the operation. The government has a system for making staff pay for items lost or damaged under their responsibility.

5.3 Incineration and Final Disposal of Non-DDT Waste

AIRS Ethiopia has inherited large quantities of insecticide waste and two small mobile incinerators that are being used to dispose of non-DDT-contaminated insecticide waste. The waste was accumulated from IRS operations in all PMI-supported districts from 2009 to 2011 and from the AIRS Ethiopia spray campaign of 2012. In 2012, AIRS worked with the Oromia Environmental Protection Authority (EPA) and health office to secure a permit and a site for incineration. As a result, the project performed the following activities:

- Hired two incinerator operators;
- Incinerated more than 20,000 kg of non-DDT-contaminated insecticide waste; and
- Collected all non-DDT waste of the 36 districts where AIRS sprayed in 2013.

The remaining non-DDT waste is estimated to be about 9,700 kg. AIRS Ethiopia plans to destroy all non-DDT-contaminated waste before the next spray round. No outsourcing will be required.

5.4 Disposal of DDT and DDT Waste

PMI has asked AIRS Ethiopia to explore disposal options within and/or outside of Ethiopia for DDT and non-DDT waste that has accumulated in the aforementioned past spray campaigns. The project is also assessing options for the disposal of expired DDT in 60 previous and current project district stores. Cost estimates for packaging, collection, transport, and incineration have been finalized.

5.5 Mid- and Post-spray Inspection Report

All AIRS Ethiopia technical team members, including the Spray Operations Coordinator, Operations Manager, Technical Manager, M&E Manager and Database Manager, were involved in environmental

compliance inspections. The team members divided six zones and 36 project districts among themselves to conduct supervision and pre-, mid-, and post-spray inspections of the spray campaign in all districts.

During the supervision and environmental inspection visits, the team used AIRS project-wide checklists to observe soak pits, bath rooms, insecticide storage conditions, community involvement, house preparation, IEC and performance of spray operators. District Malaria Focal Persons and Zonal Malaria Focal Persons were actively involved as supervisors on behalf of district health offices. At the end of each inspection, district health teams supervising IRS held a general discussion on the status, achievements, short-comings, and constraints and then forwarded the recommendations to district offices for corrective actions to be taken.

The team made a general observation that there is tremendous improvement in the quality of spray operations and IRS infrastructure achieved in 2013 comparing to previous IRS campaigns. During the inspections, the AIRS team witnessed many best practices applied properly and regularly during the spray operations. The districts have openly embraced the IRS best practices and most performed very well during 2013 spray season. Noted excellent recording and tracking of insecticide that should be applied to other IRS materials contained in the district stores. The stock management although good, can be improved if all records are updated regularly. The remaining insecticide-contaminated wastes such as empty sachets, used masks, torn gloves and contaminated boxes were accumulated and stored in the district stores until they will be moved to the central store near Addis Ababa for incineration. Overall, spray actors used PPE appropriately, although in some instances, spray operators required reminders to use masks, gloves, boots and coveralls properly. Some squad leaders were not wearing helmets and face shields when observing spraying. Some washers did not wear full PPE while doing the cleaning and washing. The inspection teams provided corrective actions and recommendations on the spot to the extent possible. A report with specific findings and recommendations is included in Annex C.

6. ENTOMOLOGY

The 2013 work plan of AIRS Ethiopia included a number of entomological monitoring activities to be implemented in collaboration with the ORHB, the FMOH, and Jimma and Addis Ababa universities. As a result, Jimma, Addis Ababa and Mekelle University experts participated in entomlogical activities that include IR monitoring, behavior and density studies and entomology trainings. A number of these activities were also carried out by the AIRS entomology team. The major activities carried out from January to August 2013 were monitoring the efficacy and residual life of carbamates sprayed on different types of walls; monitoring vector behavior and density; doing insecticide susceptibility tests and bioassays for insecticide quality control and decay rate; measuring the resting preference of vectors; and monitoring insecticide resistance using CDC bottle assays and other entomological study methods.

6.1 INSECTARY

PMI/AIRS Ethiopia supports a well-functioning insectary in Nazareth. The insectary is owned by the ORHB. Earlier, PMI rehabilitated and equipped the insectary. Under the AIRS Ethiopia project, PMI provides regular support for procurement and care of lab animals for mosquito feeding, maintenance of insectary equipment, and payment of temporary staff. The insectary is a reliable source of susceptible mosquitoes for all entomological monitoring activities undertaken by the AIRS team. The insectary also serves as a learning center for a number of local and international trainings on entomology.

6.2 STUDY ON THE IMPACT OF TYPES OF WALL SURFACES ON RESIDUAL LIFE OF CARBAMATES

Results of monthly bioassay test on different types of walls are presented in Table 11. Four types of wall surfaces were evaluated for their effect on the residual efficacy of carbamates. The mortality rate was 100 percent with bendiocarb up to six months post spray on painted surfaces, significantly higher than on other surfaces. Residual life of propoxur was little affected by wall surfaces; more than 90 percent mortality was recorded for six months post spray on all wall surfaces. (A separate report has been submitted for this activity).

TABLE 11. RESIDUAL EFFICACY OF CARBAMATES SPRAYED ON DIFFERENT WALL SURFACES

Insecticide Sprayed	Types of Walls	Time Post Spray						
			Months					
		24 hrs	1	2	3	4	5	6
Bendiocarb	Painted	100	100	100	100	100	100	100
	Dung plastered	100	63.3	55.6	22.2	7.1	0.4	1.3
	Mud, wetted with water	100	66.7	0	15.2	2.2	6.7	9.4
	Mud plastered	100	66.7	4.4	4.4	6.7	16.3	9.7
Propoxur	Painted	100	100	100	100	100	100	100
	Dung plastered	100	100	100	100	100	92.8	92.9

Insecticide Sprayed	Types of Walls	Time Post Spray						
			Months					
		24 hrs	1	2	3	4	5	6
	Mud, wetted with water	100	93.3	100	100	100	100	100
	Mud plastered	100	81	100	100	100	95.3	100
Local water	Painted	0	0	0	2.2	0	6.1	3.3
	Dung plastered	0	3.3	0	0	2.3	2.9	0
	Mud, wetted with water	0	3.3	0	0	0	2.5	6.7
	Mud plastered	0	0	4.4	6.7	6.7	0	3.3

6.3 Determination of Quality of Spraying and Persistence

The AIRS Ethiopia team conducted cone bioassay tests in eight sites; two DB IRS and six CB IRS districts. In each of the CB IRS districts, five kebeles were randomly selected for observation by AIRS evaluators, and one of the five was randomly selected for the bioassay test. When the randomly selected kebele was found to be too difficult to access, the next nearest kebele was selected.

The AIRS Ethiopia team performed the tests in five houses per kebele purposefully selected to represent houses sprayed by different SOPs and housing types. The tests were carried out using known susceptible mosquito colonies reared in the Adama Malaria Reference Training Center insectary and wild mosquitoes reared from larvae or pupae (2–3-day-old sugar-fed adult *An. gambiae* s.l.).

Mortality of wild mosquitoes was 99 percent in one of the community-based districts (Kersa) and 98 percent in one of the district-based sites (Omo Nada). Mortality of lab-reared and wild mosquito was 100 percent in all other sites tested 1–7 days after spray. There was no difference in results between the community- and district-based IRS models. (A separate report has been submitted for this activity.)

6.4 Monitoring Vector Density and Behavior

Three sites were selected for vector density and behavior monitoring where pre- and post-spray data collection was conducted. The sites are Gambela Tere kebele in Gobu-Seyo district and Seka Chekorsa intervention sites, and Ejaji in Ilu Gelan district, a control/unsprayed site. A pre-spray assessment was conducted before the spraying began and the studies were repeated one month after spray. Selected results of pre and post spray for one intervention village and one control village are presented. Data collection and analysis is ongoing; a comprehensive report will be submitted once all data are analyzed.

6.4.1 Larval Collection

Total larvae collected from breeding habitats increased from 178 pre-spray to 360 per 600 dips post spray in the intervention village; *An. gambiae* s.l. larvae increased from 37 to 141. Similarly, in the control village, total anopheline and *An. gambiae* s.l. larvae increased from 91 to 208 and from 55 to 86, respectively. Both in the intervention and control areas, post-spray larval density increases were statistically significant ($p<0.05$) when compared to pre-spray data. Complete data from control and intervention sites are provided in Table 12. The possible explanation of the findings is that larval collections are hard to standardize and it is difficult to reduce collectors' bias. Not all larval breeding habitats can be searched for larvae and the collection sites during pre-spray are different from those sites in post spray. Fewer and shrinking water collections found post spray after the rains can hold higher concentration of larvae than the numerous and diffused water collections sampled during the rainy season of pre-spray. Mosquitos will have much fewer options to lay eggs after the rains (post spray) creating concentration in fewer sites, which will be easier to sample. However, it creates bias in

pre and post spray comparisons. AIRS Ethiopia team recommends dropping out larval collection and outdoor adult collection methods as a monitoring tool because both methods are very difficult to standardize and have very limited importance.

TABLE 12. LARVAL DENSITY PER 600 DIPS IN INTERVENTION AND CONTROL SITES, PRE AND POST SPRAY

Sites	Spray	Total Anopheline	1st and 2nd Instar	3rd and 4th Instar	Total Pupae	*An. gambiae*	*An. pharoesnis*	*An. coustani*	*An. demeloni*
Intervention	Pre	178	141	37	27	37	0	0	0
	Post	360	242	118	53	101	4	2	11
Control	Pre	91	55	36	28	36	0	0	0
	Post	208	86	122	44	94	9	19	0

6.4.2 PYRETHRUM SPRAY COLLECTION

Indoor resting *An. gambiae* s.l. mosquitoes collected from 20 houses using the Pyrethrum Spray Collection (PSC) method decreased from 1,145 pre spray to 29 post spray in the intervention village; this number increased from 114 to 147 in the control village. All mosquitoes from PSC catches were classified for their abdominal stages (unfed, fed, half gravid, and gravid). The ratio of gravid and half gravid to fed mosquitoes during pre-spray indoor resting collection in the intervention village was 1 to 7, indicating the vector's preference to rest outdoors (exophilic).

In other words, more fed mosquitoes were collected than half gravid and gravid combined. Other factors could have been involved but the reason could also be due to exophilic behavior as the expectation is to have more half or full gravid mosquitoes than fed mosquitoes collected indoors if the vector is endophilic. The vector seems to prefer resting outdoors irrespective of the spray status though the numbers collected post spray was very small. Spray seems not to have an effect on the vector resting behavior. The same ratio was 1.45 to 1 pre spray and 1.4 to 1 post spray in the control village indicating the same exophilic tendencies. This could also be affected by weather and other human activities. The result is expected given *An. arabiensis* is the sole member of species complex found in most parts of the country. Detailed analysis of these data will be included in a separate entomological report. Complete data from control and intervention sites are provided in Tables 13 and 14.

TABLE 13. INDOOR RESTING COLLECTION OF MOSQUITOES: PRE AND POST SPRAY AT INTERVENTION VILLAGE, GOBU SAYO

Blood Stage	*An gambiae* s.l.		*An pharoensis*		*An coustani*		*An demeloni*	
	Pre	Post	Pre	Post	Pre	Post	Pre	Post
Unfed	181	7	15	4	0	2	0	0
Fed	842	16	4	3	0	3	0	1
Half gravid	88	5	3	0	1	0	0	4
Gravid	34	1	3	0	0	1	0	0
Total	1145	29	25	7	1	6	0	5

TABLE 14. INDOOR RESTING COLLECTION OF MOSQUITOES: PRE AND POST SPRAY AT CONTROL SITE, ILU GELAN

Blood Stage	*An. gambiae s.l.*		*An. pharoensis*		*An. coustani*		*An. demeloni*	
	Pre	Post	Pre	Post	Pre	Post	Pre	Post
Unfed	16	17	0	0	0	0	0	0
Fed	58	76	0	0	0	0	0	0
Half gravid	19	28	0	1	0	0	0	0
Gravid	21	26	0	0	0	0	0	0
Total	114	147	0	1	0	0	0	0

6.4.3 HUMAN LANDING CATCHES

A human landing collection (also called man landing catch) was undertaken before and one month after the spray. Two collectors (one sitting indoor and the other outdoor) spent the whole night (6 pm to 6 am), 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 village, the team collected 1346 *An. gambiae* s.l. before vs. 404 one month after the spray. The result in the control site was 94 vs. 47. During pre-spray collection, the indoor vs. outdoor ratio for *An. gambiae* s.l. was 1 to 1.78 in the intervention site and 1 to 1.13 in the control site. During post-spray monitoring, the ratio for indoor vs. outdoor for *An. gambiae* s.l. was 1 to 1.98 and 1 vs. 1.76 in the intervention and control sites, respectively. A total of 300 (indoors) vs. 997 (outdoors) other anopheline mosquitoes were caught attempting to bite humans in both intervention and control sites during both pre- and post-spray collections; 99 percent of the other anopheline mosquitoes were collected from the intervention village. Similarly, a large number *Culex* of (3,783) were collected trying to bite collectors pre and post spray and in both sites. Figures 2 and 3 demonstrate the results of eight man-night collections for each the intervention and control village.

FIGURE 2. HUMAN LANDING COLLECTIONS: PRE AND POST SPRAY AT GOBU SAYO (INTERVENTION SITE)

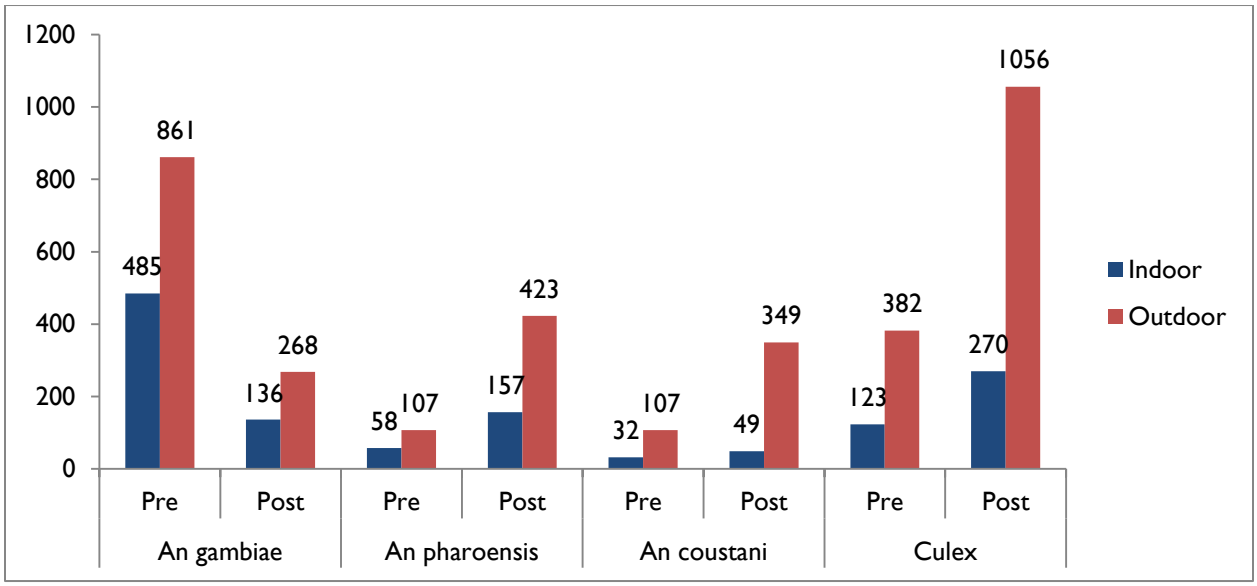
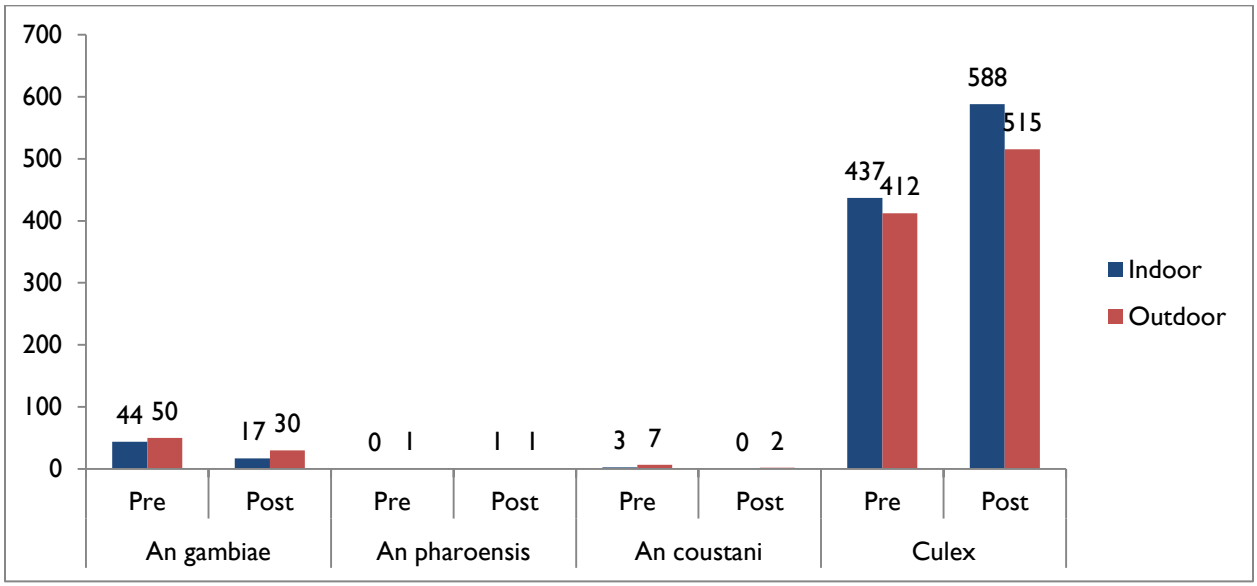


FIGURE 3. HUMAN LANDING COLLECTIONS:
PRE AND POST SPRAY AT ILU GELAN (CONTROL SITE)



Overall human landing catch collection results showed that vector biting was consistently lower indoors than outdoors, indicating a tendency of exophagic habits. To further elaborate on these findings, the data indicate that the vector has both options but it prefers biting people sitting outdoors than those sitting indoors. However, because people spend more time indoors than outdoors, most of the vector-human contact occurs indoors, which means people can still be protected by IRS and bed nets; both will remain effective. Biting time seem to be peaking towrads the middle or end of the night in all the 3 sentinel sites. It is lowest during the first 2-3 hours after dusk. See figures 4-9 for complete data.

FIGURE 4. BORE TIKA BEFORE SPRAY (INTEVENTION)

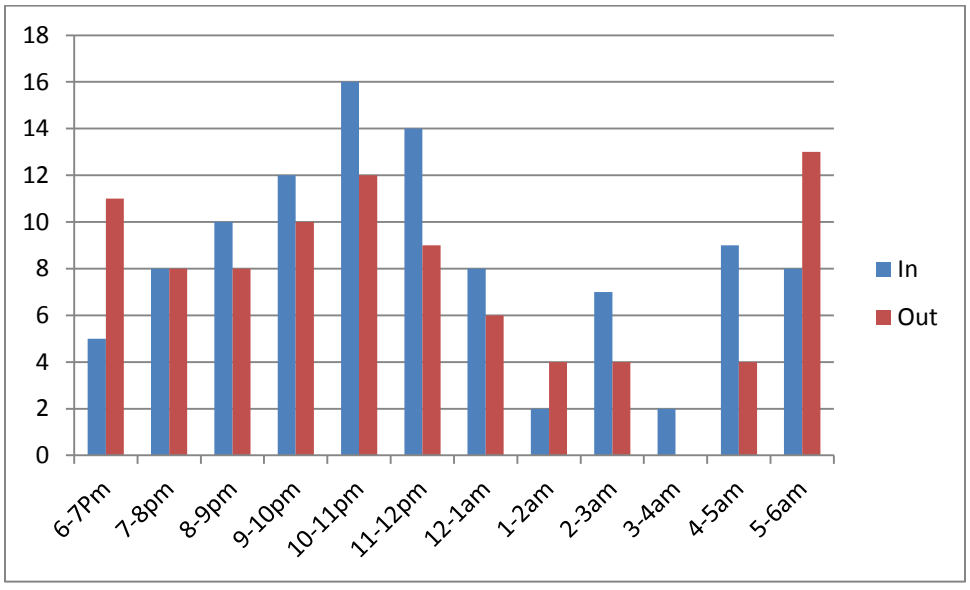


FIGURE 5. BORE TIKA AFTER SPRAY (INTEVENTION)

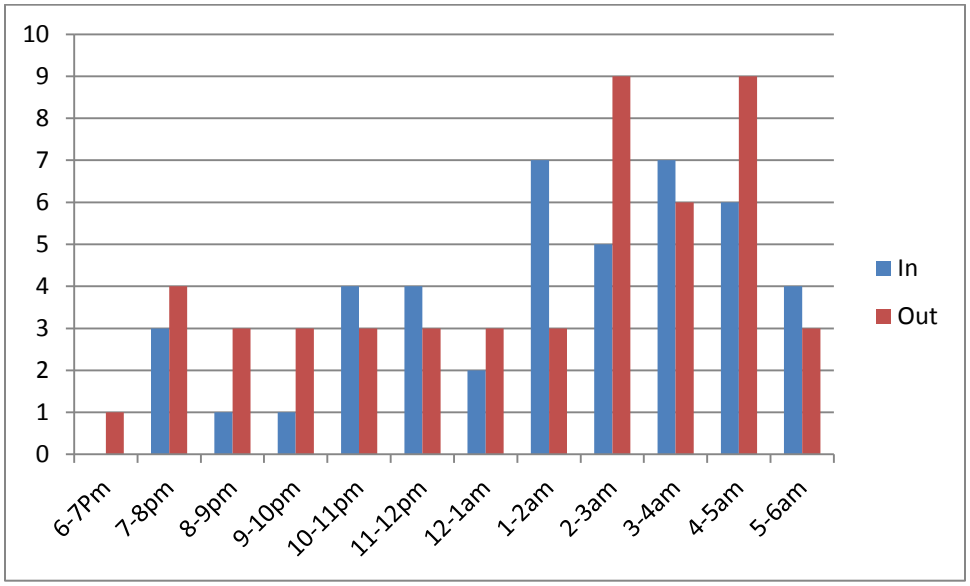


FIGURE 6. GOBU SAYO BEFORE SPRAY (INTEVENTION)

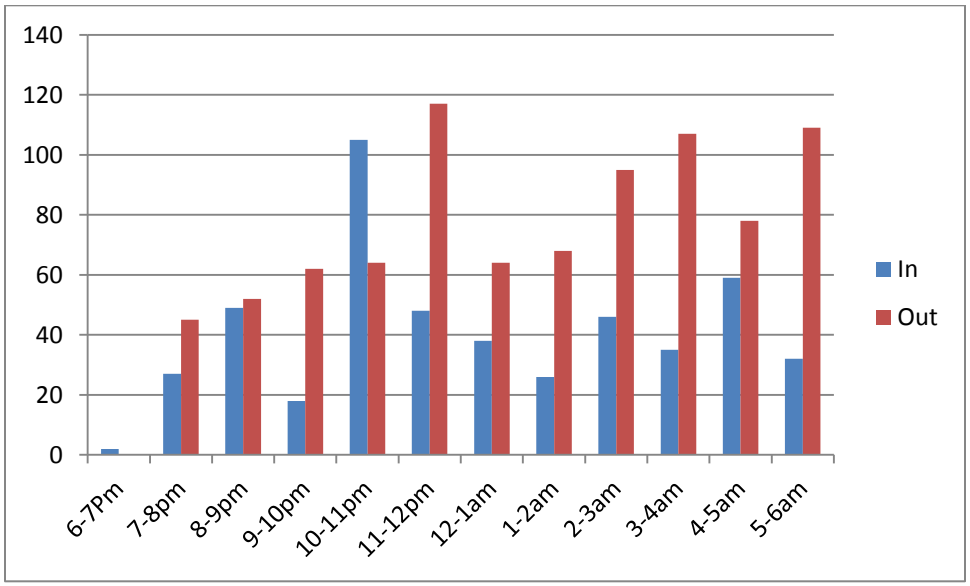


FIGURE 7. GOBU SAYO AFTER SPRAY (INTEVENTION)

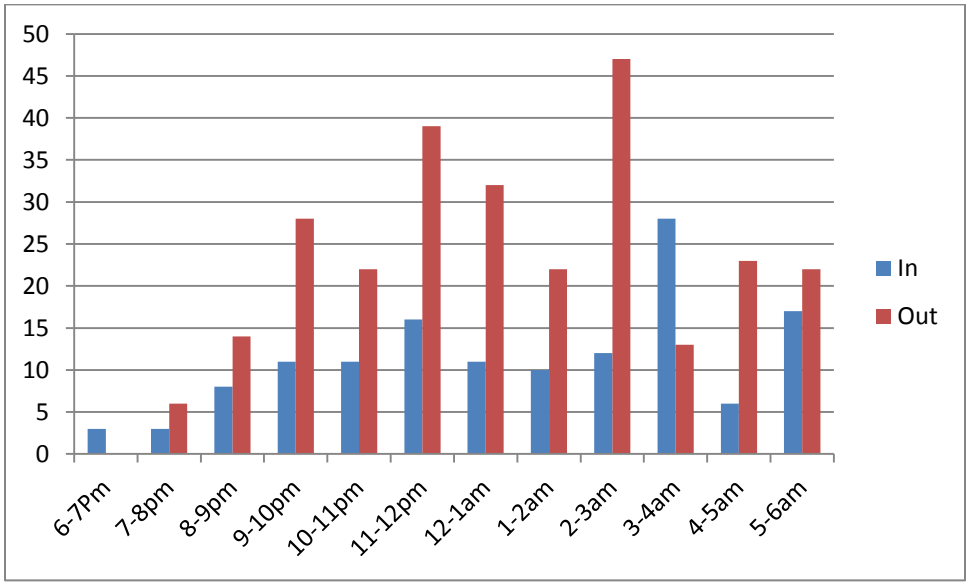


FIGURE 8. ILU GELAN BEFORE SPRAY (CONTROL)

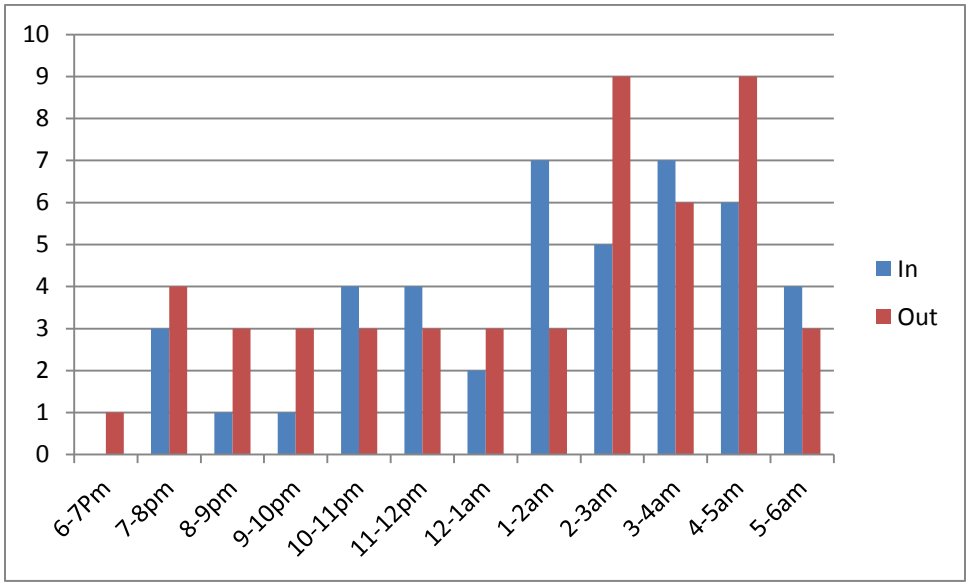
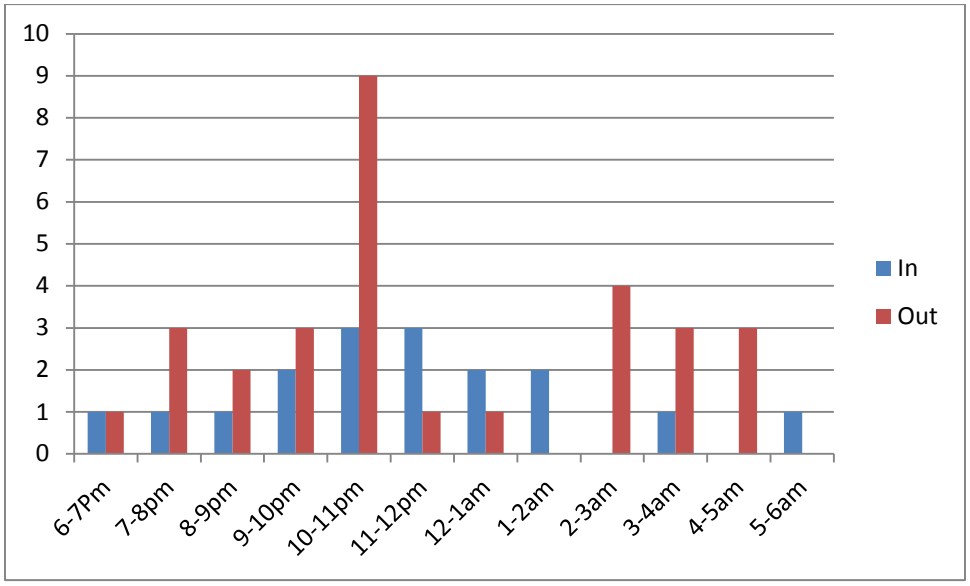


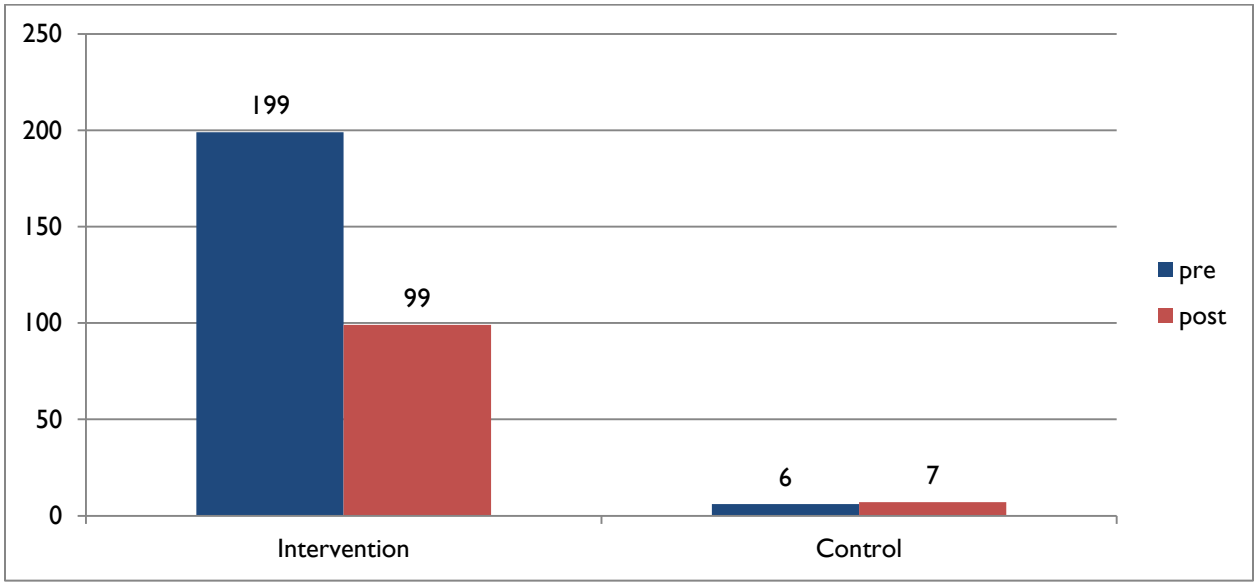
FIGURE 9. ILU GELAN AFTER SPRAY (CONTROL)



6.4.4 CDC LIGHT TRAPS

CDC light traps collection was undertaken in two houses for two nights in each. Density was higher pre spray (199) than post spray (99) in the intervention village. The numbers were similar for pre and post spray in the control village, as shown in Figure 10.

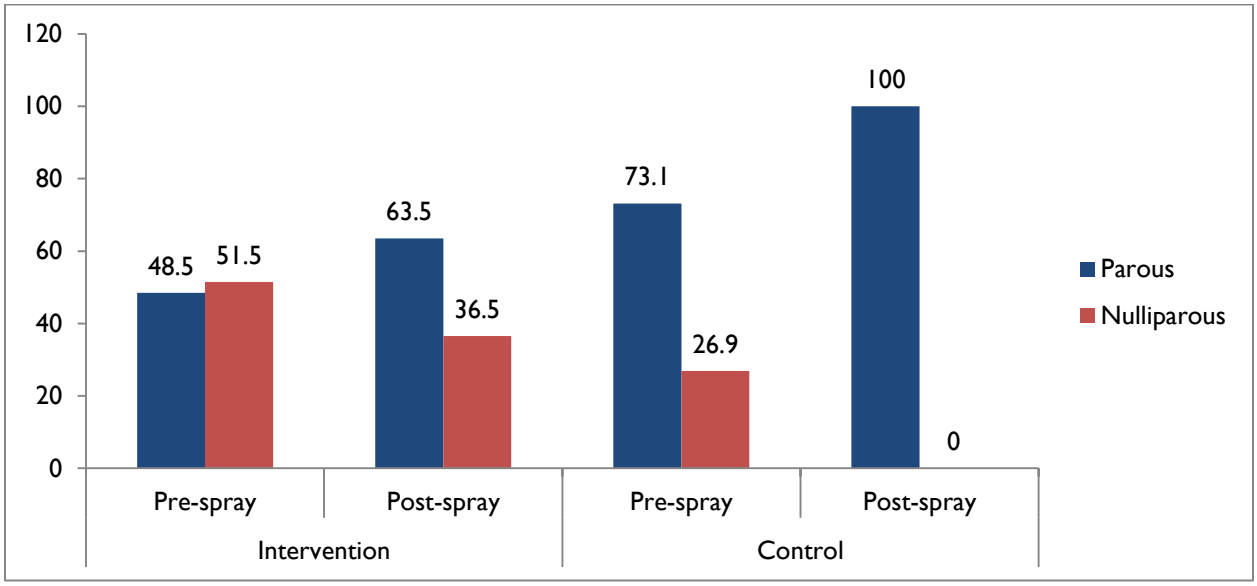
FIGURE 10. INDOOR CDC LIGHT TRAP COLLECTION PRE AND POST SPRAY IN INTERVENTION AND CONTROL SITES



6.4.5 PARITY RATE

Ovary dissection was performed on all unfed female mosquitoes captured during the pre- and post-spray human landing collections to determine the rate of parity. Pre spray, 48.5 percent dissected vectors were parous in the intervention village and 73.1 percent in the control. Post spray, this figure was 63.5 percent in the intervention village and 100 percent in the control village. The proportion of parous vectors was higher post spray contrary to expectations that spray reduces parity rates. However, climatic and environmental factors such as rainfall, flooding, and drying of breeding habitats can affect the proportion of parous mosquitoes in the population. Figure 11 illustrates the results.

FIGURE 11. PROPORTION OF PAROUS AND NULLIPAROUS *AN. GAMBIAE*, PRE AND POST SPRAY IN INTERVENTION AND CONTROL



6.4.6 INSECTICIDE SUSCEPTIBILITY

According to the 2013 work plan, the susceptibility level of *An gambiae* complex, the major malaria vector in Ethiopia, to 8–10 World Health Organization Pesticide Evaluation Scheme (WHOPES)-recommended insecticides is to be tested in five fixed sites in Ethiopia. Omonada and Chewaka are current project districts, Zwai is a PMI graduated district, Halaba and Bahrdar are South Nations Nationalities and Peoples and Amahra regional states respectively. The tests were completed in two sites and will be done in November 2013 in the remaining sites. Two to three-day-old female mosquitoes reared from larvae were used for the test. The test results showed the vector is highly resistant to DDT, lambda cyhalothrin, deltamethrin, permethrin, alpha-cypermethrin, and etofenprox; moderately resistant to malathion; and susceptible to bendiocarb, propoxur, fenitrothion and pirimiphos methyl (Table 15).

TABLE 15. INSECTICIDE RESISTANCE RESULTS IN FIVE FIXED SITES

No.	Insecticide	% Mortality				
		Omonada	Zwai	Chewaka	Bahrdar*	Halaba*
1	DDT	9	26	22	16	
2	Lambda cyhalothrin	15	-	44	-	

3	Deltamethrin	26	36	51	20	
4	Fenitrothion	97	-	100	100	
5	Malathion	81	90	71	33.3	
6	Pirimiphos methyl	100	100	100	100	
7	Propoxur	98.1	100	100	96	
8	Bendiocarb	92	100	100	75	
9	Permethrin	22	-	-	-	
10	Alpha cypermethrin	-	32	-	42.7	
11	Etofenprox	-	20	-	54.7	

*Test to be done in November

Similar tests were conducted at the request of PMI Ethiopia office for two non-AIRS but PMI/UNICEF project districts in the Oromia region. The results are shown in Table 16 and susceptibly level of the vector was similar to that of the five sentinel sites.

TABLE 16. OTHER INSECTICIDE RESISTANCE TESTS PERFORMED BY AIRS

No.	Insecticide	% Mortality	
		Ameya District	Wonchi District
1	DDT	2	4
2	Lambda cyhalothrin	9	18
3	Deltamethrin	16	23
4	Fenitrothion	100	100
5	Malathion	60	88
6	Pirimiphos methyl	100	100
7	Propoxur	100	100
8	Bendiocarb	100	100
9	Permethrin	12	19.1

6.5 RESTING SITE PREFERENCE BY *AN. GAMBIAE* S.L.

The objective of this study was to assess the resting habit of the main vector (*An. gambiae* s.l.) mosquitoes and determine the relative frequency of the vector mosquitoes resting in non-living structures of a house, such as the kitchen, latrine, animal quarters, and grain store, compared with the living quarters. The test was done two months before spray and one month post spray. In both collections, vector resting density found to be higher in animal quarters than in the living areas, kitchens, latrines, and grain stores as shown in Table 17.

TABLE 17. RESTING PREFERENCE OF *AN. GAMBIAE* S.L.

Structures	# of Female *An. gambiae* s.l. Collected	
	Pre spray	Post spray
Living quarters	660	27
Animal quarters	2790	917

Kitchen	216	49
Latrine	54	18
Grain store	53	21

6.6 Mosquito Collection from Water Retention Sites

The Ethiopian government is undertaking a new water and soil conservation program for using structures dug to retain water. The aim is to conserve water and moisture and increase agriculture productivity in water-scarce areas. AIRS investigated the role of these structures in producing adult vectors. During the four-week collection period, a total of 15 *An. gambiae* s.l. and 2,150 *Culex* were collected. Nine (60 percent) of *An. gambiae* s.l. were collected in modified traps and the remaining six (40 percent) were collected in traditional traps. The water retention holes were shallow and the soil porous; as a result, they dried up within a week after the rains stopped. These structures may not be big contributors to the mosquito population in areas similar to the study site.

6.7 Malaria Decision Support System

Earlier in the year, experts from the Innovative Vector Control Consortium (IVCC)/Liverpool School of Tropical Medicine (LSTM) conducted a workshop for the AIRS Ethiopia team to introduce the Malaria Decision Support System (MDSS, now Disease Data Management System, DDMS). They also supplied a training version of the database, which had an option for entering insecticide resistance data. IVCC/LSTM also developed a database to accommodate other entomological indicators but it was not finalized at the time of the workshop. In the fall, IVCC/LSTM reported that they have configured DDMS and uploaded functional version on to the AIRS Ethiopia server. The configured database is capable to enter and analyze all entomological indicators. To initiate the data analysis and reporting, the AIRS project developed reporting templates that IVCC/LSTM is currently programming into the database. Next steps will be to test the reports, present examples to PMI and conduct a second workshop for the AIRS Ethiopia team to ensure that the project team can do comprehensive management and maintenance of the database from the Addis office.

7. MONITORING AND EVALUATION

7.1 APPROACH AND KEY OBJECTIVES

The overarching M&E approach of AIRS Ethiopia was to use the local lessons learned in combination with successful aspects of M&E systems to:

- Emphasize accuracy of both the data collection and the data entry process 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 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.

7.2 DATA COLLECTION AND DATA QUALITY ASSURANCE PROTOCOLS

Data were 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: 1) Training Participant Registration Form, 2) Daily Spray Operator Form, 3) Squad Leaders Daily Summary Form, 4) Team Leaders Daily Summary Form, and 5) District Malaria Focal Person Daily Summary Form. For M&E spray data entry purposes, AIRS Ethiopia only uses 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.

In 2013, the AIRS project introduced four paper-based data quality assurance tools: the Error Eliminator (EE) Form, Data Collection Verification (DCV) Form, Data Entry Verification (DEV) Form, and Data Entry Center Supervision Checklist – in order to improve supervision of data collection and data entry. These tools are fully described in Table D-2 in Annex D.

Additionally, AIRS Ethiopia introduced 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 functionalities – 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, kebele), per spray operator, etc. These various reports require no computer knowledge or individual analysis, simply the click of a button. Hence, they can be 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 is used by DECs for data verification and daily data cleaning. The M&E team and spray supervisors can also use the cleaning function to perform data verification (e.g., looking up the spray data for a specific day, spray operator, or structure). This was previously not possible.

While the M&E Manager in Ghana originally developed the tool for local use, because it was designed to connect to the standardized Abt Client Technology Center designed database backend, it was easily transferable to other countries. The AIRS Ethiopia Database Manager was able to take the Ghana version of the tool and customize and expand it for the Ethiopia context.

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, which was used by AIRS staff and government supervisors to capture issues and guide feedback during spray operations. The most common issues found during use of the DCV form are summarized in Table 18.

TABLE 18. USE OF DCV FORM; COMMON ISSUES FOUND AND CORRECTIVE ACTIONS TAKEN

Errors/Issues Observed	Corrective Actions Taken
Underreported mosquito nets It was observed that households underreported the mosquito net ownership to supervisors using the DCV Form with the expectation of getting another mosquito net.	The M&E team and supervisors provided orientation to spray teams, explaining that to capture the correct numbers on mosquito ner ownership, SOPs should be clear that the data collection is not to inform mosquito net distribution. Those using the DCV Form also informed households that the interview was not being used to inform future net distribution.
Unmarked structures found SLs did not consistently mark structures with chalk.	The M&E team and supervisors addressed SLs, TLs, and field supervisors, providing on-the-spot correction and training.
Missing IRS card numbers It was found that some households did not have IRS cards when interviewed.	The team provided reserve IRS cards during spray operations to be distributed to households needing replacement IRS cards, i.e., to household that did not retain their cards from 2012. Additionally, SOPs were told to emphasize to households the importance of keeping their IRS cards in a safe place.
Unsprayed structures found Unsprayed structures that were initally overlooked by SOPs were found in few villages.	M&E team and supervisors worked to arrange revisits to these areas so that the missed structures could be covered.
IRS cards not updated We found that SLs were not updating the 2013 section of the IRS cards with 2013 spray information: date of spray, name and code of SOP, total # of eligible structures found and sprayed.	Orientation was provided to SLs to remind them to update the 2013 section of IRS cards.
Spraying not eligible structures We found in a few cases that ineligible structures had been sprayed.	SLs and TLs were retrained on the identification of eligible unit structures.
Inaccurate reporting of children under 5 The number of children under 5 reported during DCV household interviews at times differed from what was reported on the Daily Spray Operator Form. It was unclear which data were accurate as often not all children would be present to be correctly counted.	It was brought to the program's attention that in some areas, beneficiaries deem it inasupicious to "count" their children. Thus, accurate reporting of children under 5 living in a struture continued to be a challenge.

See Table D-3 in Annex D for a summary the AIRS programs' method and tools for addressing core areas of data quality concern.

7.3 Data Entry

AIRS employed 36 DECs; one per district. The 2013 AIRS Ethiopia database along with the new 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. 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.

7.4 Data Storage

The Daily Spray Operator forms are stored in binders at 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, first, into a back-up folder on the data entry laptop; second, into a cloud back-up system (Sugar Sync); and third, into an external memory drive that was provided to each DEC.

7.5 Data Cleaning and Use of the DEV Form

The M&E Manager, Database Manager, and Information Technology (IT) Specialist facilitated data cleaning at the district level, which involved the following:

- Ensuring that all Daily Spray Operator forms are entered correctly by the double entry method (by totals and by details);
- Ensuring that all necessary corrections are made so that the totals and aggregate details per form are in agreement;
- Checking and removing duplicate records; 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 within 10 days after the end of the spray campaign.

Data entry verification was done throughout the campaign using the DEV. It involved ensuring that information in the database accurately reflected the information as written on the Daily Spray Operator Forms. Table D-4 in Annex D details the data entry verification performed in each district. A total of 3,790 detail lines of data were verified using the DEV form by the M&E team.

Common errors in data entry included: incorrect spelling of household names, incorrect entry of IRS numbers, and the incorrect entry of population in sprayed and unsprayed structures. These errors were duly rectified.

7.6 Reporting of Spray Data

Spray data were collected and entered into the database on a daily basis. SLs collected the data while TLs checked and verified data. Further checks were completed by MFPs, IEC specialists, and district EC 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 the PMI. Internally, the Ethiopia M&E team provided comprehensive spray updates three times a week to facilitate timely corrective actions.

All AIRS Ethiopia performance indicators are presented in a Monitoring and Evaluation 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.

7.6.1 Number of Structures Found, Sprayed, and Spray Coverage

At total of 638,173 structures were found by SOPs during the 2013 spray campaign across all the 36 districts, of which a total of 635,528 structures were sprayed, for a total spray coverage of 99.6 percent. District-level data are presented in Table 19. In total, SOPs found 317,760 living/sleeping structures and sprayed 316,090 (99.5 percent) of them. AIRS Ethiopia used five types to categorize the various types of structures eligible for spray. Table 20, which follows Table 19, presents the spray data disaggregated by type.

7.6.2 Population Protected

A total of 1,629,958 people were protected through the AIRS program in 2013, out of which 25,211 were pregnant women and 240,558 were children under 5. Thus, the vulnerable groups accounted for 16.3 percent of the total population protected via IRS.

TABLE 19. SUMMARY OF 2013 SPRAY RESULTS

Zone	District	Total # of Eligible structures found by SOPs	Total # Eligible structures Sprayed	Spray Coverage	Population Protected	Pregnant Women Protected	Children < 5 Protected	TOTAL Population	% Population Protected
Kellem Wollega	Dale Sadi	14,381	14,377	100.0%	28,973	221	3,963	28,984	100.0%
	Dale Wabara	19,064	19,043	99.9%	40,313	554	5,184	40,391	99.8%
	Hawa Galan	27,048	26,988	99.8%	67,226	1,518	11,102	67,272	99.9%
	Lalo Kile	13,379	13,270	99.2%	26,510	205	2,977	26,774	99.0%
	Seyo	15,829	15,829	100.0%	41,658	453	5,345	41,658	100.0%
	Kellem Wollega TOTAL	89,701	89,507	99.8%	204,680	2,951	28,571	205,079	99.8%
East Wollega	Boneya Boshe	10,537	10,502	99.7%	18,727	223	2,608	18,832	99.4%
	Dega	12,360	12,352	99.9%	32,185	459	4,868	32,188	100.0%
	Gida Ayana	20,377	20,314	99.7%	42,516	474	5,468	42,653	99.7%
	Gobu Sayo	11,632	11,560	99.4%	25,376	305	3,455	25,556	99.3%
	Guto Gida	14,130	14,059	99.5%	37,733	684	5,499	37,898	99.6%
	Limmu	11,251	11,037	98.1%	22,125	240	2,516	22,711	97.4%
	Sasiga	14,923	14,892	99.8%	41,524	540	5,589	41,539	100.0%
	Wama Hagalo	17,287	17,273	99.9%	37,489	553	6,334	37,543	99.9%
	Wayu Tuka	14,485	14,485	100.0%	32,145	356	3,864	32,145	100.0%
	East Wollega TOTAL	126,982	126,474	99.6%	289,820	3,834	40,201	291,065	99.6%
West Shoa	Bako Tibe	16,599	16,582	99.9%	44,795	370	5,370	44,862	99.9%
	Danno	18,815	18,687	99.3%	53,291	452	7,690	53,823	99.0%
	Dendi	13,164	12,983	98.6%	34,330	326	4,152	34,676	99.0%
	Ilu Galan	19,137	19,136	100.0%	43,611	491	6,402	43,615	100.0%

Zone	District	Total # of Eligible structures found by SOPs	Total # Eligible structures Sprayed	Spray Coverage	Population Protected	Pregnant Women Protected	Children < 5 Protected	TOTAL Population	% Population Protected
	Nonno	14,730	14,659	99.5%	39,005	433	5,223	39,223	99.4%
	West Shewa TOTAL	82,445	82,047	99.5%	215,032	2,072	28,837	216,199	99.5%
Jimma	Kersa	26,761	26,587	99.3%	75,380	930	10,754	75,803	99.4%
	Omonada	32,022	31,952	99.8%	95,948	1,582	15,055	96,264	99.7%
	Seka Chekorsa	21,451	21,416	99.8%	55,668	729	8,443	55,747	99.9%
	Sekoru	22,175	22,175	100.0%	64,812	709	9,325	64,812	100.0%
	Shabe Sombo	15,468	15,452	99.9%	37,334	344	4,635	37,379	99.9%
	Tiro Afeta	22,865	22,605	98.9%	69,528	918	10,367	70,333	98.9%
	Jimma TOTAL	140,742	140,187	99.6%	398,670	5,212	58,579	400,338	99.6%
Ilu Aba Bora	Bedele	9,842	9,816	99.7%	23,897	556	4,355	23,976	99.7%
	Borecha	23,271	23,271	100.0%	39,581	2,186	7,404	39,581	100.0%
	Chewaka	27,201	27,196	100.0%	77,979	1,913	13,443	78,004	100.0%
	Dedesa	13,029	12,969	99.5%	30,490	635	5,687	30,641	99.5%
	Ilu Aba Bora	73,343	73,252	99.9%	171,947	5,290	30,889	172,202	99.9%
West Wollega	Babo Gamebel	17,334	17,330	100.0%	43,447	599	6,154	43,458	100.0%
	Begi	17,141	17,141	100.0%	49,260	921	9,553	49,260	100.0%
	Guliso	12,260	11,873	96.8%	32,549	210	3,792	34,087	95.5%
	Kiltu Kara	11,949	11,946	100.0%	31,876	190	2,931	31,881	100.0%
	Manasibu	28,444	28,386	99.8%	66,233	690	8,981	66,281	99.9%
	Nejo Rural	18,374	18,007	98.0%	47,349	388	4,908	48,013	98.6%
	Kondola	19,458	19,378	99.6%	79,095	2,854	17,162	79,480	99.5%

Zone	District	Total # of Eligible structures found by SOPs	Total # Eligible structures Sprayed	Spray Coverage	Population Protected	Pregnant Women Protected	Children < 5 Protected	TOTAL Population	% Population Protected
	West Wollega	124,960	124,061	99.3%	349,809	5,852	53,481	352,460	99.2%
GRAND TOTAL		**638,173**	**635,528**	**99.6%**	**1,629,958**	**25,211**	**240,558**	**1,637,343**	**99.5%**

TABLE 20. SUMMARY OF STRUCTURES FOUND AND SPRAYED BY TYPE AND ROOM COVERAGE

Zone	District	Sleeping/Living structure			Kitchen		Animal Shed		Latrine		Other structure		Not categorized		Eligible rooms		
		Found	Sprayed	% of Sleeping/ Living Structures Sprayed	Found	Sprayed	Found	Sprayed	Found	Sprayed	Found	Sprayed	Found	Sprayed	Found	Sprayed	% of Rooms sprayed
Kellem Wollega	Dale Sadi	5,533	5,530	99.9%	3,610	3,609	3,942	3,942	1,086	1,086	210	210	0	0	23,665	23,635	99.9%
	Dale Wabara	7,635	7,618	99.8%	6,073	6,071	3,303	3,302	1,162	1,161	891	891	0	0	27,490	27,460	99.9%
	Hawa Galan	12,927	12,904	99.8%	7,647	7,631	5,206	5,192	1,001	995	267	266	0	0	39,172	39,069	99.7%
	Lalo Kile	4,699	4,647	98.9%	2,733	2,712	3,573	3,547	1,658	1,650	716	714	0	0	21,385	21,041	98.4%
	Seyo	7,799	7,799	100.0%	6,125	6,125	1,307	1,307	99	99	499	499	0	0	30,664	30,560	99.7%
Kellem Wollega Total		38,593	38,498	99.8%	26,188	26,148	17,331	17,290	5,006	4,991	2,583	2,580	0	0	142,376	141,765	99.6%
East Wollega	Boneya Boshe	4,188	4,162	99.4%	1,741	1,738	4,489	4,485	79	77	40	40	0	0	13,789	13,655	99.0%
	Diga	6,256	6,255	100.0%	4,120	4,115	1,162	1,161	790	789	32	32	0	0	16,597	16,584	99.9%
	Gida Ayana	9,031	8,996	99.6%	7,728	7,706	2,599	2,597	367	367	652	648	0	0	32,097	32,050	99.9%
	Gobu Sayo	4,758	4,717	99.1%	3,624	3,601	2,767	2,761	159	159	324	322	0	0	16,768	16,624	99.1%
	Guto Gida	7,444	7,408	99.5%	4,726	4,701	1,077	1,074	840	833	43	43	0	0	17,631	17,511	99.3%

Zone	District	Sleeping/Living structure			Kitchen		Animal Shed		Latrine		Other structure		Not categorized		Eligible rooms		
		Found	Sprayed	% of Sleeping/ Living Structures Sprayed	Found	Sprayed	Found	Sprayed	Found	Sprayed	Found	Sprayed	Found	Sprayed	Found	Sprayed	% of Rooms sprayed
	Limmu	5,418	5,271	97.3%	3,669	3,617	1,518	1,508	416	416	230	225	0	0	14,853	14,597	98.3%
	Sasiga	8,680	8,677	100.0%	3,017	3,006	735	732	2,315	2,302	176	175	0	0	20,908	20,854	99.7%
	Wama Hagalo	6,335	6,324	99.8%	4,432	4,429	3,817	3,817	919	919	1,784	1,784	0	0	23,507	23,421	99.6%
	Wayu Truka	6,120	6,120	100.0%	5,007	5,007	2,666	2,666	468	468	224	224	0	0	19,553	19,553	100.0%
East Wollega Total		58,230	57,930	99.5%	38,064	37,920	20,830	20,801	6,353	6,330	3,505	3,493	0	0	175,703	174,849	99.5%
West Shoa	Bako Tibe	8,895	8,881	99.8%	3,929	3,928	2,936	2,934	155	155	684	684	0	0	27,873	27,637	99.2%
	Danno	11,090	10,972	98.9%	5,103	5,094	2,517	2,516	103	103	2	2	0	0	25,826	25,652	99.3%
	Dendi	6,323	6,241	98.7%	4,017	3,966	2,343	2,313	189	188	292	275	0	0	16,722	16,489	98.6%
	Ilu Galan	8,873	8,872	100.0%	4,268	4,268	5,310	5,310	115	115	571	571	0	0	31,181	31,018	99.5%
	Nonno	7,455	7,402	99.3%	4,373	4,356	1,477	1,476	104	104	1,321	1,321	0	0	18,072	17,919	99.2%
West Shoa Total		42,636	42,368	99.4%	21,690	21,612	14,583	14,549	666	665	2,870	2,853	0	0	119,674	118,715	99.2%
Jimma	Kersa	14,735	14,627	99.3%	6,673	6,631	4,864	4,844	145	145	343	339	1	1	51,685	51,233	99.1%
	Omo Nada	17,493	17,443	99.7%	5,044	5,037	4,999	4,993	538	537	3,947	3,942	1	0	59,664	59,505	99.7%
	Seka Chekorsa	10,787	10,763	99.8%	4,660	4,654	2,855	2,854	164	164	2,985	2,981	0	0	38,753	38,655	99.7%
	Sekoru	12,276	12,276	100.0%	4,571	4,571	4,348	4,348	28	28	952	952	0	0	32,375	32,359	100.0%
	Shebe Sombo	8,222	8,210	99.9%	3,666	3,665	3,006	3,005	37	37	537	535	0	0	23,818	23,594	99.1%
	Tiro Afeta	16,545	16,352	98.8%	2,831	2,786	3,363	3,342	63	62	63	63	0	0	30,816	30,350	98.5%
Jimma Total		80,058	79,671	99.5%	27,445	27,344	23,435	23,386	975	973	8,827	8,812	2	1	237,111	235,696	99.4%
Ilu Aba	Bedele	5,501	5,485	99.7%	1,292	1,289	2,910	2,903	136	136	3	3	0	0	12,485	12,450	99.7%

Zone	District	Sleeping/Living structure			Kitchen		Animal Shed		Latrine		Other structure		Not categorized		Eligible rooms		
		Found	Sprayed	% of Sleeping/ Living Structures Sprayed	Found	Sprayed	Found	Sprayed	Found	Sprayed	Found	Sprayed	Found	Sprayed	Found	Sprayed	% of Rooms sprayed
Bora	Borecha	7,573	7,573	100.0%	5,121	5,121	6,607	6,607	3,252	3,252	718	718	0	0	36,501	36,496	100.0%
	Chewaka	15,863	15,858	100.0%	3,471	3,471	6,957	6,957	792	792	118	118	0	0	31,236	31,176	99.8%
	Dhedessa	5,926	5,894	99.5%	2,047	2,039	4,378	4,364	71	71	607	601	0	0	16,360	16,182	98.9%
Ilu Aba Bora Total		34,863	34,810	99.8%	11,931	11,920	20,852	20,831	4,251	4,251	1,446	1,440	0	0	96,582	96,304	99.7%
West Wollega	Babo Gambel	9,413	9,412	100.0%	5,270	5,268	1,641	1,640	228	228	782	782	0	0	35,267	35,222	99.9%
	Begi	7,722	7,722	100.0%	5,165	5,165	1,187	1,187	72	72	2,995	2,995	0	0	27,285	27,277	100.0%
	Guliso	6,531	6,191	94.8%	3,501	3,476	1,248	1,244	204	204	773	755	3	3	24,630	23,544	95.6%
	Kiltu Kara	5,855	5,854	100.0%	4,367	4,365	1,661	1,661	4	4	62	62	0	0	23,200	22,963	99.0%
	Manasibu	11,285	11,275	99.9%	10,037	10,031	5,453	5,445	1,227	1,198	442	437	0	0	51,146	50,982	99.7%
	Nejo Rural	8,879	8,731	98.3%	6,718	6,523	1,681	1,678	458	447	638	628	0	0	33,980	32,256	94.9%
	Kondala	13,695	13,628	99.5%	1,627	1,621	1,875	1,873	5	5	2,253	2,250	3	1	29,341	28,710	97.8%
West Wollega Total		63,380	62,813	99.1%	36,685	36,449	14,746	14,728	2,198	2,158	7,945	7,909	6	4	224,849	220,954	98.3%
Grand Total		317,760	316,090	99.5%	162,003	161,393	111,777	111,585	19,449	19,368	27,176	27,087	8	5	996,295	988,283	99.2%

7.6.3 Availability and Use of Mosquito Nets

Across the 36 districts, households reported having a total of 292,137 mosquito nets available at the time the SOP visited during the 2013 spray campaign. In total, 13,846 pregnant women were reported as having slept under a mosquito net the night prior to the SOP's visit. Additionally, 141,852 children under 5 years of age were reported as having had slept under a mosquito net the previous night. See Table 21 for mosquito net indicators presented by zones and districts.

TABLE 21. NUMBER AND USE OF MOSQUITO NETS

Zone	District	Total # of Mosquito Nets Found	# of Pregnant Women Sleeping Under Mosquito Nets	# of Children <5 Sleeping Under Mosquito Nets
Kellem Wollega	Dale Sadi	119	6	71
	Dale Wabara	859	6	53
	Hawa Galan	522	67	200
	Lalo Kile	2,809	81	1,019
	Seyo	13,252	422	5,136
	Kellem Wollega TOTAL	**17,561**	**582**	**6,479**
East Wollega	Boneya Boshe	6,319	177	2,145
	Dega	721	65	488
	Gida Ayana	5,841	278	3,589
	Gobu Sayo	5,049	178	2,308
	Guto Gida	8,979	555	4,901
	Limmu	1,187	42	602
	Sasiga	1,495	40	471
	Wama Hagalo	14,694	495	5,754
	Wayu Tuka	3,509	153	1,851
	East Wollega TOTAL	**47,794**	**1,983**	**22,109**
West Shoa	Bako Tibe	2,748	117	1,316
	Danno	11,224	358	6,517
	Dendi	5,294	295	3,547
	Ilu Galan	5,801	260	4,087
	Nonno	6,344	297	3,856
	West Shewa TOTAL	**31,411**	**1,327**	**19,323**
Jimma	Kersa	10,931	330	5,079
	Omonada	33,459	1,281	12,738
	Seka Chekorsa	16,715	569	7,114
	Sekoru	19,606	587	8,063

Zone	District	Total # of Mosquito Nets Found	# of Pregnant Women Sleeping Under Mosquito Nets	# of Children <5 Sleeping Under Mosquito Nets
	Shabe Sombo	6,960	161	2,641
	Tiro Afeta	22,173	601	6,755
	Jimma TOTAL	**109,844**	**3,529**	**42,390**
Ilu Aba Bora	Bedele	7,593	523	4,244
	Borecha	232	36	172
	Chewaka	5,934	758	4,774
	Dedesa	6,193	478	4,218
	Ilu Aba Bora TOTAL	**19,952**	**1,795**	**13,408**
West Wollega	Babo Gamebel	9,945	393	4,018
	Begi	12,595	915	9,537
	Guliso	371	7	111
	Kiltu Kara	1,038	28	349
	Manasibu	15,711	509	6,088
	Nejo Rural	11,195	238	3,319
	Kondola	14,720	2,540	14,721
	West Wollega TOTAL	**65,575**	**4,630**	**38,143**
GRAND TOTAL		**292,137**	**13,846**	**141,852**

7.6.3.1 OTHER SPRAY INDICATORS

Table 22 below provides detailed insecticide usage and Spray Operator performance per district.

TABLE 22. INSECTICIDE USE AND SPRAY OPERATOR PERFORMANCE

Zone	District	SOP Performance	Sachet Use		
		Average # of Unit Structures per SOP per Day	Sachets Used	Average # of Structures Sprayed/ Sachet	Average # of Sachets per SOP per Day
Kelem Wollega	Dale sadi	16.9	6,631	2.2	7.8
	Seyo	15.8	7,491	2.1	7.5
	Dale wabara	17.4	9,096	2.1	8.3
	Hawa Galan	25.6	12,175	2.2	11.5
	Lalo Kile	17.0	6,451	2.1	8.2
	Kelem Wollega TOTAL	18.7	41,844	2.1	8.7

East Wollega	Boneya boshe	14.8	4,665	2.3	6.6
	Dega	18.1	5,217	2.4	7.6
	Gobu Sayo	16.1	5,195	2.2	7.2
	Wama Hagalo	15.7	9,351	1.8	8.5
	Guto Gida	16.7	6,594	2.1	7.8
	Limmu	15.0	4,622	2.4	6.3
	Sasiga	18.9	5,360	2.8	6.8
	Gida Ayana	15.3	9,637	2.1	7.2
	Wayu Tuka	14.7	7,135	2.0	7.2
	East Wollega TOTAL	**16.0**	**57,776**	**2.2**	**7.3**
West Shewa	Danno	15.8	9,270	2.0	7.8
	Dendi	15.5	6,523	2.0	7.8
	Nonno	15.6	8,761	1.7	9.3
	Bako Tibe	14.6	7,870	2.1	6.9
	Ilu Galan	14.0	9,954	1.9	7.3
	West Shewa TOTAL	**15.0**	**42,378**	**1.9**	**7.8**
Jimma	Omonada	14.7	20,414	1.6	9.4
	Seka chekorsa	16.2	10,894	2.0	8.2
	Sekoru	17.5	11,129	2.0	8.8
	Shabe Sombo	16.5	6,861	2.3	7.3
	Kersa	14.5	16,147	1.6	8.8
	Tiro Afeta	14.2	11,777	1.9	7.4
	Jimma TOTAL	**15.4**	**77,222**	**1.8**	**8.5**
Ilu Aba Bora	Bedele	16.6	5,346	1.8	9.0
	Borecha	16.6	12,021	1.9	8.6
	Dedesa	14.4	5,513	2.4	6.1
	Chewaka	15.7	12,538	2.2	7.2
	Ilu Aba Bora TOTAL	**15.8**	**35,418**	**2.1**	**7.7**
West Wollega	Kiltu Kara	17.5	5,105	2.3	7.5
	Babo Gamebel	17.1	8,222	2.1	8.1
	Guliso	14.8	4,674	2.5	5.8
	Manasibu	17.0	12,714	2.2	7.6
	Begi	16.5	8,085	2.1	7.8
	Kondola	16.6	6,976	2.8	6.0
	Nejo Rural	15.7	8,307	2.2	7.2
	West Wollega TOTAL	**16.5**	**54,083**	**2.3**	**7.2**
Grand Total		**16.1**	**308,721**	**2.1**	**7.8**

7.7 IMPACT OF IRS ON MALARIA CONTROL

To better understand the effect of IRS and how it might be most effectively targeted within districts, AIRS Ethiopia planned for collection and analysis of the relevant epidemiological data in order to provide evidence for better targeting of IRS interventions. Specifically, in Year Two, AIRS Ethiopia began to access data and assess data completeness in 15 treatment and proposed comparison districts. This was started during post-spray down time after Year One spray operations and rolled over into Year Two through field visits to the districts of interest and collaboration with the local MFPs. AIRS Ethiopia found that reporting by health facilities and districts to have significant inconsistencies. Cleaning of the data will resume after the Post-Spray Data Quality Audit in Year Two and will be completed early in Year Three. Once the data is cleaned, the team will review evaluate the limitations of the data and design the research design based on these limitations. This will guide the continued data collection in Year Three and final analysis of the data. Relevant activities in Year Three will be sponsored with Core funds.

8. Lessons Learned and Recommendations

1. Project districts are highly scattered across the region and far from AIRS office, making supervision and coordination a challenge. In 2013, the technical AIRS team members, specifically the M&E Manager, Database Manager, Technical Manager, Operations Coordinator, and the Spray Operations Coordinator, served as IRS campaign zonal supervisors in addition to their program-wide technical oversight duties. While this allowed more focused zonal supervision, it proved to be very challenging for the technical AIRS team members to balance both technical and zone specific supervision. Given the large scope of work that AIRS Ethiopia technical staff needs to perform serving as zonal supervisors during the IRS campaign in addition to providing technical support in their respective areas across the whole program, the project may consider hiring 3-4 full-time zonal coordinators to support the overall campaign in the assigned zones in 2014. This will free up the AIRS technical team to travel across all program districts and focus efforts on areas that are having specific technical challenges. This decision will be subject to availability of funds.
2. Size and comfort of boots was an issue for some SOPs. The fact that boots are procured internationally, before the SOPs are recruited, makes buying the correct sizes difficult. Some districts succeeded in convincing spray actors to buy their own boots and this was discussed as a best practice during the end of spray conference. This practice would be encouraged or the project will support local procurement of boots by spray actors.
3. Use of polyethylene sheets to cover cracked concrete and temporary soak pit floors is a cost-effective and quick solution to minimize the soil contamination. AIRS Ethiopia will continue this practice in 2014.
4. Outsourcing construction of soak pits with proper guidance and close supervision where it is possible is more efficient than the project building the soak pits.
5. Involvement of district health office and district technical staff in construction of soak pits is a good practice to increase district ownership among the health officers. The project will work with the health centers' managers to involve the center resources in soak pit construction activities in the future.
6. Except for the core team of AIRS experts, the workers involved in the spray operation are employees of the district and zonal health offices. The AIRS team pays the per diem to the health office staff for their contribution to the spray operation. Although AIRS can deny paying the per diem or request that a poorly performing worker be replaced, there is little AIRS Ethiopia can do to penalize these workers when their performance is substandard. In some instances AIRS rejected the involvement or demanded the removal of poorly performing district staff from the spray operation. Health managers at the zonal offices were very cooperative and understanding with such requests and addressed them accordingly. Importance of close supervision and addressing issues immediately after they are identified during the earlier days of the spray operations to the district supervisors will be reinforced during the trainings.
7. A few operation sites were inaccessible due to heavy rains and bad roads; farm tractors were used to deliver supplies in some cases or districts were forced to work from one operation site.

8. Competing priorities of the district health offices delayed SOP training and start of spray operations in some districts, particularly in the CB IRS districts where the HEWs were assigned different tasks at the time of the start of spray campaign. This issue was discussed with the management of the health offices at all levels during the post spray meeting. Management promised to avoid task overlap with spray operation.
9. Network connectivity was a problem in several districts over the course of the IRS campaign. This issue inhibited DECs from daily syncing spray data to cloud storage and thus inhibited the ability of the M&E team to create program-wide data reports. As a workaround for this challenge, the M&E team would call DECs, who would be able to provide the district-level data by running the local report and verbally providing the figures to the M&E or Database Manager.
10. A large order for internationally procured items arrived late and processing their clearance took some time. Although this did not cause the delay of the campaign start but it delayed earlier distribution from the central store to districts. The team will plan for earlier procurement and distribution of IRS logistics.
11. Mixing insecticide in the tank was not also uniform. Some SOPs were dropping the sachet in 4 liter water; then adding the remaining 4 liters of water and then pumping (4-5) followed by shaking. Others were dropping the sachet in full tank (8liters of water), then pumping (4-5 times) followed by shaking. Though both techniques are acceptable, AIRS Ethiopia will enforce a uniform procedure in the next cycle.
12. During the spraying, the team observed inconsistent marking of the houses. Some districts used it, some did not. Some IRS managers guided the spray leaders to mark all sprayed structures, some guided to mark not-sprayed structures for mop-up. Therefore, the team will provide clear guidance during the trainings on a consistent marking of the structures.
13. Rental vehicles with PPE and for transporting SOPs have been arriving to the districts later than planned during the dispatch from Addis. One of the explanations is that the drivers of rental cars are trying to pick up some work on the way and it delays their arrival to the districts. The team will investigate an option of performance-based payment to the drivers to ensure they arrival time is within given time limit.
14. Storage spaces at the health posts in the communities did not meet required size standards but due to lack of other available space, the project used them for storing IRS materials during the spray period. AIRS Ethiopia will advocate for the construction of mini stores at the village level for the CB IRS.

ANNEX A. 2013 IRS PROCUREMENT

TABLE A-1. PPE AND OTHER SUPPLIES PROCURED

Items	30 Districts (DB IRS)	6 Districts (CB IRS)	24 Graduated Districts	Non PMI Districts
International Procurement				
Spray pump	50	228	182	0
Spare part kit	50	30	27	0
Tip T-jet nozzle	1200	456	1418	0
Face shield	820	278	350	5000
Helmet /Hard hat		228		2500
Gumboots / Pair /	820	420	1594	0
N95 Respirator /mask/each	61,310	16,000	47,850	75,000
Rubber Gloves /Pair/	10,000	3024	6376	1,552
Bendiocarb (Ficam)	40,008 kg (3334 boxes) (400,080 sachets). Procured directly by PMI.			
Local Procurement				
Plastic sheet (2X3M)	500	336	1053	0
Haversack	100	84		0
Overalls	1000	1008	1594	2500
Nylon rope roll(100mt)	270	0	0	0
Basin 40 lit	82	84	123	
Polyethylene sheet (8X4M)	50	0	0	0
Polyethylene sheet (4X2M)	0	89	0	0
Laundry soap	62	28		
Toilet soap	341			
Chalk (Box of 50)	331			
Towel	1312			
D-cell battery	656			
Candle in pcs	820			
Bucket 20 lit	588			
Jerry can 20 lit		168		
Calculator	30			
Toolkit	60			
First aid kit	82			
Warning sign	30			

Items	30 Districts (DB IRS)	6 Districts (CB IRS)	24 Graduated Districts	Non PMI Districts
Apron	82	84		
Jug 2 liter	280	280	192	
IRS card	200,000	52,000		

ANNEX B. LENGTH OF SPRAY OPERATION

TABLE B-1. START AND END DATE OF 2013 SPRAY OPERATION BY DISTRICT

	District	Start of IRS Operation	End of IRS Operation	Total Days
		DB IRS		
1	Limu	18/8/13	22/9/13	36
2	Dega	15/8/13	17/9/13	34
3	Gida Ayana	15/8/13	22/9/13	37
4	Guto Gida	15/8/13	22/9/13	37
5	Wayu Tuka	17/8/13	21/9/13	36
6	Gubu Sayo	15/8/13	19/9/13	36
7	Boneya Boshi	15/8/13	21/9/13	38
8	Wama Hagelo	15/8/13	18/9/13	35
9	Nonno	15/8/13	21/9/13	38
10	Dendi	15/8/13	16/9/13	33
11	Danno	15/8/13	27/9/13	44
12	Ilu Galan	15/8/13	20/9/13	37
13	Begi	19/8/13	22/9/ 13	35
14	Kondala	16/8/13	21/9/ 13	39
15	Babo Ganbel	18/8/13	21/9/ 13	35
16	Kiltu Kara	15/8/13	18/9/13	37
17	Nejo	16/8/13	20/9/13	38
18	Bedele	17/8/13	21/9/13	36
19	Didesa	18/8/13	25/9/13	39
20	Borecha	17/8/13	22/9/13	37
21	Sokoru	16/8/13	23/9/13	41
22	Seka	15/8/13	18/9/13	35
23	Shebe	15/8/13	20/9/13	37
24	Omo Nada	15/8/13	20/9/13	37
25	Tiro Afeta	15/8/13	19/9/13	36
26	Guliso	17/8/13	21/9/13	36

27	Seyo	15/8/13	21/9/13	38
28	Dale Webera	15/8/13	20/9/13	37
29	Dale Sadi	15/8/13	20/9/13	37
30	Lalo Kile	15/8/13	17/9/13	34
		CB IRS		
31	Sasiga	20/8/13	23/9/13	35
32	Bako Tibe	19/8/13	21/9/13	34
33	Kersa	17/8/13	22/9/13	37
34	Chewaka	20/8/13	17/9/13	29
35	Hawa Gelan	18/8/13	18/9/13	31
36	Mana Sibu	20/8/13	23/9/13	35

ANNEX C. 2013 MID- AND POST-SPRAY INSPECTION REPORT

Introduction

The African Indoor Residual spraying (AIRS) Ethiopia project conducted 2013 spray operation from August 15to September 27in 36 PMI-supported districts. The average number of operational days was 30.7. The project used two models of IRS campaign 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.

All AIRS Ethiopia technical team, including Spray Operations Coordinator, Operations Manager, Technical Manager, M&E Manager and Database Manager, was involved in environmental compliance inspections. The team members divided six 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, bath rooms, insecticide storage conditions, community involvement, house preparation, IEC and performance of spray operators.

During the 2013 spray round inspections, District Malaria Focal Persons and Zonal Malaria Focal Persons were actively involved as supervisors on behalf of district health offices. At the end of each inspection, district health teams supervising IRS held a general discussion on the status, achievements, short-comings, 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 FY2013 IRS operation in Ethiopia was:

- Ascertain the level to which Ethiopian IRS operation is compliant with USAID's Pesticide Procedures specified in the Federal Regulations 22CFR216 as specified in the Ethiopia IRS PERSUAP/SEA and the IRS guidelines.
- Work with the district, zonal, regional health offices and federal ministry of health to observe progress of IRS activities, 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 processes to prevent pilferage ("leakage")/misuse of insecticides outside of 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.
- Observe spray operators' compliance with best IRS management practices in project sites to

ascertain if they are being followed during spraying.

General Observation

Overall in DB IRS, there 74 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 soak pits, which were located one in each sprayed village. All project-supported districts have proper stores to keep insecticides and other IRS materials. The remaining insecticide-contaminated wastes such as empty sachets, used masks, torn gloves and contaminated boxes were accumulated and stored in the same stores until they will be moved to the central store near Addis Ababa for incineration.

Mid-inspection Observations

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

All districts had good and working soak pits in all the sites including the temporary soak pits in CB IRS districts. There are only two soak pits, which had water drainage issues. The reason was the mud that the spray operators brought from the field on their boots that got washed into the soak pit and blocked the water runoff.

All district stores had appropriate shelves and racks to make the stock neatly stored and easy to manage.

The insecticide and other IRS materials were properly kept in separate rooms to prevent insecticide contamination.

Majority of home owners removed their belongings including food items from the houses before spraying. However, the challenge was in some communities when the rains started and it was wet outside to keep the household items, so the tenants moved them to the center of a largest room.

AIRS team provided all districts with plastic sheets to cover household items that were kept inside during spraying but not all districts distributed them to spray operators at the beginning of the spray campaign or gave out one sheet for two operators. Inspection teams corrected this action and followed up with districts to make sure each spray operator had individual plastic sheet to cover household belongings that stayed inside during spraying.

Areas for Improvement

Stock Management

While the district teams have done an excellent job in insecticide management, they have not included other IRS materials in the practice in few districts. In most stores, stock cards for other IRS materials were not regularly updated. Incoming and outgoing ledger books were not updated daily either. This was a common problem. Storekeepers were reminded to update the records for every item in the warehouse whenever the stock movement occurs.

Recommendations

- Stock cards should be updated for all materials in the warehouse including consumable items
- Stock cards should be updated on the day there is movement of stock in or out of the warehouse.

Prevention Clogging of Soak Pits

Because of the muddy conditions, two soak pits were clogged, which made coverall washing and pump-rinsing procedures very time-consuming because the water was collecting and not draining in the pit. Luckily, the clogging did not cause any environmental damage because the water did not overflow into the surroundings.

Recommendations:

- Spray operators should be encouraged to remove or wash away the mud from their boots before entering the soak pit.
- The top gravel layer that is mixed with mud can be removed temporarily, rinsed and replaced.

Appropriate Use of PPE

Spray operators needed reminders and close supervision to use masks, gloves, boots and coveralls properly. Some squad leaders were not wearing helmets and face shields when observing spraying. Some washers did not wear full PPE while doing the cleaning and washing. Face shields were sometimes not properly cleaned; as a result, spray operators lift them up during spraying for better vision. Some coveralls had no buttons. The buttons had been lost during operations and never replaced to provide adequate protection.

Recommendations:

- Continue close supervision of the spray actors to make sure that they properly use all PPE.
- Guide and remind to spray operators to clean face shields with towels whenever they become dirty.
- Damaged PPE should be mended or removed from circulation.

Management of IRS Wastes

All districts had a good management system in place for collection and temporary storage of empty sachets. Empty sachets were properly counted, labeled in boxes and bags and securely stored in the district stores. Used masks were collected daily and stored in a separate areas or special "waste" boxes in district stores. However, some of the used masks were seen thrown around the wash areas and camp sites. All IRS wastes (contaminated boxes, torn gloves, masks, etc.) regardless of the level of contamination risk, should be collected in a central point for appropriate disposal. From most DB IRS districts, all empty sachets were brought to AIRS central store area for incineration. From CB IRS districts, which had only one vehicle per district, and few DB IRS remotely-located districts, the wastes were not returned immediately after the spray ended.

Recommendations:

- Used masks are contaminated wastes and should be collected and securely stored in the warehouse and will be disposed together with empty sachets.
- All IRS wastes, regardless of the level of contamination risk, should be collected for appropriate disposal.

Existence of Thermometer and Temperature Recordings

The project distributed thermometers to record maximum and minimum daily temperatures to all district stores. Most storekeepers recorded the temperature on a daily basis. In very few districts temperatures were not recorded because the storekeepers did not know how to use the thermometers.

Recommendations:

- Some storekeepers did not know how to reset the thermometers or read the temperature. Recommendation is to refresh the knowledge of the storekeepers during the IRS training on how to read and reset the maximum and minimum temperature thermometers.
- Maximum and minimum temperature readings should be read at intervals and recorded on a chart even after the IRS campaign because the insecticide is kept in the district stores until the next spray round.

Handling of Spray Pumps and Overall Supervision

There were observed variations amongst spray operators with insecticide mixing procedure including frequency of pump agitation. Some spray operators were having problems with their pumps while in the field. The team observed that some pumps had insecticide mix discharge due to loose connection between the nozzle tip and lances. Observed uneven swathes and blockage of nozzles seem to be arising from a lack of proper cleaning of pumps or perhaps the inadequate mixing of the chemicals.

Recommendations:

- All pump should be cleaned regularly, proper functioning and connection of all pump parts checked daily to eliminate leakage and other malfunctions.
- Squad leaders should be carrying some spare nozzle tips to the field
- Supervisors should also be supervising the cleaning of pumps.
- Regular supervision of spray operations should be continued to ensure:
- That quality of spraying is maintained with right speed and correct distance from the wall and using uniform mixing procedure according to IRS guidelines.
- Supervisors should ensure that all spray operators carry with them plastic covering which should be used to cover materials not removed from the houses.
- Supervise washers and storekeepers to ensure that they use PPE during washing and whenever handling insecticide.

Post -spray Activities and Inspections

All contaminated IRS wastes (empty sachets, used masks) from most districts were collected and returned to the central ware houses.

IRS wastes from CB districts and wastes in few districts were collected, labelled and stored in the district ware houses.

All PPE including coveralls were properly washed and stored in the district stores.

Spray pumps and remaining spare parts were correctly handled and stored.

AIRS team completed stock inventory in all districts.

Remaining insecticide from the spray round inventory was completed and stored safely in the district stores.

Polyethylene used as ground cover onsoak pit sites was correctly washed and stored in district stores.

Plastic sheets properly collected from spray operators washed and stored properly.

Recommendations

- District stores should be regularly cleaned and maintained in off-spray season.
- Temperature recording should be continued for the chemical safety of insecticide.
- All districts should send IRS waste to the central store for final incineration

Conclusion

There is tremendous improvement in the quality of spray operations and IRS infrastructure achieved in 2013 comparing to IRS campaigns conducted by a previous contractor. During the inspections, the AIRS team observed many best practices applied properly and regularly during the spray operations. The districts have embraced the IRS best practices and mostly performed very well during 2013 spray season. The excellent recording and tracking of insecticide should be applied to other IRS materials contained in the district stores. The stock management although was good but can be improved if all records are updated regularly. The recommendations above are aimed at pushing the performance standards even higher to ensure continuous environmental and health safety of the beneficiaries and spray implementers during the IRS intervention.

ANNEX D. DATA COLLECTION AND QUALITY ASSURANCE TOOLS

TABLE D-1. ETHIOPA IRS 2013 DATA COLLECTION TOOLS

Data Collection Tool	Useage
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 SLs during spray operations to capture structures found, structures sprayed and unsprayed, population protected, 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 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 re-training 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 SOPs under their supervision. • IEC on a daily basis to check 37.5% of the forms filled by SOPs under his/her supervision • District MFP on a daily basis to check 12.5% of the forms filled by SOPs under his/her supervision
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.

Data Quality Assurance Tool	Purpose and Usage
	Used during field audits by: • AIRS M&E and Database Managers • AIRS Operations Manager • AIRS Spray Operations Coordinator • Zonal District MFPs • District Heads and Vice Heads • District Environmental Compliance Experts
Data Entry Verification (DEV) Form	Purpose: • To verify data entry accuracy, i.e., ensure the data in the database match the data as noted on the data collection form and information collected from households using DCVs. Used during visits to data entry centers by: • Database Manager during M&E Manager • IT Specialist during their visit to a data entry center. See Table 7.4.1 • A total of 2,608 lines (2,167 detail lines and 441 total lines) of data were verified using the DEV form. See Table 7.4.1.
Data Entry Site Supervision Checklist	Purpose: • To check the application of data entry and documentation protocols and provide on the spot support to 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, 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 also 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 Details data, i.e. data per individual household • Use of Microsoft Access-based IRS Cleaning/Reporting tool to clean data on a daily basis • Use of DEV form to ensure accurate data entry. • 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

Quality Assurance/ Quality Control Issue	Method/Tools for Quality Assurance
	• 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. RESULTS OF USING THE DATA ENTRY VERIFICATION FORM

District	Total # of Detail Lines Checked using the DEV Form	Total # Detail Lines with Errors that were Corrected
Guto Gida	80	0
Gida Ayana	80	1
Wayu Tuka	60	0
Sasiga	60	0
Diga	120	0
Gobu Sayo	57	3
Guliso	60	0
Seka Chekorsa	410	1
Shebe Sombo	218	0
Sekoru	190	29
Bedele	330	25
Borecha	200	0
Hawa Galan	120	20
Dale Sadi	80	1
Dale Wabara	100	0
Seyo	60	0
Limmu	120	0
Ilu Galan	80	1
Boneya Boshe	60	0
Wama Hagalo	80	0
Bako Tibe	60	0
Chewaka	160	0
Dendi	120	0
Dhedessa	118	11
Tiro Afeta	217	8
Omo Nada	270	45
Kersa	280	22
Total	**3,790**	**167**

ANNEX E.: ETHIOPIA MONITORING AND EVALUATION PLAN INDICATOR MATRIX

Updated November 20, 2013

Performance Indicator	Indicator Definition	Project Year(s) Reporting	Data Source(s) and Reporting Frequency	Disaggregate	PMI/ AIRS Indicator	Annual Targets and Results					
						Year 1		Year 2		Year 3	
						Target	Results	Target	Results	Target	Results
Component 1: Establish cost-effective supply chain mechanisms including procurement, distribution and storage of IRS-related commodities and execute all aspects of logistical plans for IRS-related activities.											
1.1 Procurement											
1.1.1 Number and percentage of international insecticide procurement orders delivered in country, at port of entry, at least 30 days prior to the start of spray operations	[*Numerator:* Number of international insecticide procurements delivered in country, at port of entry, at least 30 days prior to the start of spray operations] [*Denominator:* Total number of international insecticide procurements] *Calculation:* [Numerator ÷ Denominator] x 100	Y1, Y2, Y3	*Data source*: Project records – ex: international procurement documents Air Ways Bill (AWB), Commercial Invoices *Reporting frequency*: Each spray season (annual/ semi-annual)	By Spray Campaign	AIRS	N.A.[2]	N.A.	N.A.[3]	N.A.	N.A.	

[2] Insecticide was procured by PMI.
[3] Insecticide will be procured by PMI.

Performance Indicator	Indicator Definition	Project Year(s) Reporting	Data Source(s) and Reporting Frequency	Disaggregate	PMI/ AIRS Indicator	Annual Targets and Results					
						Year 1		Year 2		Year 3	
						Target	Results	Target	Results	Target	Results
1.1.2 Number and percentage of international procurement orders (POs) for equipment, including PPE, received at port of entry, 30 days prior to start of spray operations.	[*Numerator:* Number of international procurements for equipment, including PPE, at port of entry, 30 days prior to start of spray operations] [*Denominator*: *Total number of* international procurements for equipment, including PPE.*]* *Calculation:* [Numerator ÷ Denominator] x 100	Y1, Y2, Y3	*Data source:* Project records *Reporting frequency*: Each spray season (annual/ semi-annual)	By Spray Campaign	AIRS	6; 85%	6; 5 of 6 POs were delivered 30 days prior to start of spray operations (83.3%)	1 Order; 100%	1 order, for 8 items: 1.Gloves 2.Boots 3.Respiratory masks 4.Hard hats 5.Faceshields 6.Spray pumps 7.Spare pump parts 8.Nosil tips; 100 %	1 Order 100%	
1.1.3 Number and percentage of local PPE procurement orders that are delivered to the central warehouse 14 days before the start of spray operations	[*[Numerator:* Number of local PPE procurements delivered to the main warehouse 14 days before the start of spray operations] [*Denominator*: *Total number of local PPE procurements.]* *Calculation:* [Numerator ÷ Denominator] x 100	Y1, Y2, Y3	*Data source:* Project records – ex: such as delivery notes, goods receiving notes, inventory control cards *Reporting frequency*: Each spray season (annual/ semi-annual)	By Spray Campaign	AIRS	1 for both Spray Rounds (100%)	Round1: N.A. PPE already in stock Round 2: 1for coveralls received at least 14 days before the start of spray operations (100%)	1 Order; 100%	1 order for coveralls (100%)	1Order; 100%	
1.1.4 Successfully completed spray operations without an insecticide stock-out	Milestone: (Achieved/Not Achieved)	Y1, Y2, Y3	*Data source:* Project records – *ex:* inventory control cards *Reporting frequency*: Each spray season (annual/ semi-annual)	By Spray Campaign	AIRS	Achieved	Achieved	Achieved	Achieved	Achieved	

Performance Indicator	Indicator Definition	Project Year(s) Reporting	Data Source(s) and Reporting Frequency	Disaggregate	PMI/ AIRS Indicator	Annual Targets and Results					
						Year 1		Year 2		Year 3	
						Target	Results	Target	Results	Target	Results
1.2 In-country Logistics, Warehousing, and Training											
1.2.1 Number and percentage of logistics and warehouse managers trained in IRS supply chain management	*[Numerator:* Total number of logistics and warehouse managers trained in IRS supply chain management using AIRS Project resources.] *[Denominator:* Total number of AIRS logistics and warehouse managers.] *Calculation*: [Numerator ÷ Denominator] x 100	Y1, Y2, Y3	*Data source*: Routine training records *Reporting frequency*: Semi-annually	By Spray Campaign By Gender	PMI	36 district storekeepers (100%)	Total: 36 (100%) (32 male, 4 female) Round 1: 19 (16 male, 3 female) Round 2: 17 (16 male, 1 female)	36 (100%)	36; 100% 31 Male; 5 Female; 13.9% Female	36 (100%)	
1.2.2 Number and percentage of base stores where physical inventories are verified by up-to-date stock records	*[Numerator:* Number of base stores where physical inventories are verified by up-to-date stock records] [*Denominator*: *Total number of base stores audited.]* *Calculation:* [Numerator ÷ Denominator] x 100 *(See PIRS for details on sample size for operational audits)*	Y2, Y3	*Data source:* Project records - ex: inventory control cards *Reporting frequency*: Each spray season (annual/ semi-annual)	By Spray Campaign	AIRS	N.A.	N.A.	36; 85%	36 District and 3 Central Stores (100%)	39 (36 District Stores and 3 Central) 100%	

Performance Indicator	Indicator Definition	Project Year(s) Reporting	Data Source(s) and Reporting Frequency	Disaggregate	PMI/ AIRS Indicator	Annual Targets and Results					
						Year 1		Year 2		Year 3	
						Target	Results	Target	Results	Target	Results
1.2.3 Submit up-to-date inventory records to AIRS Home Office 30 days after the end of each spray campaign	Milestone: (Completed/Not Completed)	Y2, Y3	*Data source:* Project records - ex: warehouse inventory control cards *Reporting frequency*: Each spray season (annual/ semi-annual)	By Spray Campaign	AIRS	N.A.	N.A.	100%	100%	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 IRS country work plan developed and submitted on time	Milestone: (Completed/Not Completed)	Y1, Y2, Y3	*Data source:* Project records *Reporting frequency*: Annually		AIRS	Completed	Completed	Completed	Completed	Completed	
2.2 Support of Safety and Health Best Practices and Compliance with USAID and Host Country Environmental Regulations											
2.2.1 SEA/letter report submitted on time[4]	Milestone: (Completed/Not Completed)	Y1, Y2, Y3	*Data source*: Project records – submitted SEAs/ letter reports Reporting frequency: Each spray campaign	By Spray Campaign	AIRS	Completed	Completed	Completed	Completed	Completed	
2.2.2 Number and percentage of soak pits	[Numerator: Number of soak pits and	Y1, Y2, Y3	Data source: Project records – Reports	By Spray Campaign	AIRS	#N.A for soak pits[5];	Total: 74 soak pits; 1 central	74 soak pits; 1	68 (91.9%)[6] soak pits; 36	74 soak pits; 3	

[4] In Year 1, SEAs were due 30 days prior to the commencement of spraying and letter reports were to be submitted 14 days prior to the commencement of spraying. In Year 2 and Year 3, due dates agreed upon with Washington-PMI will be noted in each country-specific Monitoring and Evaluation Plan to assess indicator 2.2.1.

[5] The number of soakpits was not finalized during workplanning.

Performance Indicator	Indicator Definition	Project Year(s) Reporting	Data Source(s) and Reporting Frequency	Disaggregate	PMI/ AIRS Indicator	Annual Targets and Results					
						Year 1		Year 2		Year 3	
						Target	Results	Target	Results	Target	Results
and warehouses/storerooms inspected and certified prior to spraying	warehouses/storerooms inspected and certified by AIRS Environmental Compliance Officer] [Denominator: Total number of project soak pits and/or storehouses] Calculation: [Numerator ÷ Denominator] x 100		submitted by environmental officers Reporting frequency: Each spray season	By soakpits and storerooms/ warehouses		1 central warehouse; 36 district storerooms; 100% inspected and approved prior to spraying	warehouse; 36 storerooms; 100% inspected prior to spraying Round 1: 41soak pits; 19 district storerooms Round 2: 33 soakpits; 17 district storerooms	central warehouse; 36 storerooms; 100% inspected prior to spraying	warehouses (100 %) and 1Central Warehouse (100%)	central warehouse and 36 store rooms; 100% inspected prior to spraying	
2.2.3 Number of government environmental and health officers trained in IRS environmental compliance	Total number of government environmental and health officers trained in IRS environmental compliance using AIRS Project resources	Y1, Y2, Y3	*Data source:* Project training reports Reporting frequency: Semi-annually	By Spray Campaign By Gender	AIRS	248[7]	Total: 255[8]; Round1: 149[9] (142 males,7 females); Round 2:106 (100 males,6 females)	285	224; 214 Male,10 Female; 4.5% Female	224	
2.2.4 Number of spray personnel trained in	Total number of spray personnel who attend a	Y1, Y2, Y3	Data source: Project records – Training	By Spray Campaign	AIRS	N.A.[10]	Total: 2,031[11]	Total: 2,124[12]	2,586; 2251 Male, 335	2,586	

[6] Due to heavy rains that resulted in impassable roads during the inspection time, AIRS Ethiopia was unable to inspect 6 soak pit areas prior to spray. These soak pits were inspected after the start of spray operations..
[7] Summary of National and Regional-level TOT for Comprehensive IRS trainees; 50 and 198 trainees respectively; See Annex B, Table 2 for training plan details.
[8] Summary of National and Regional-level TOT for Comprehensive IRS trainees; 50 and 198 trainees respectively; See Annex B, Table 3 for 2012 training results.
[9] National-level trainees were included in Round 1 Trainings
[10] Specific target was not set at time of workplanning.

Performance Indicator	Indicator Definition	Project Year(s) Reporting	Data Source(s) and Reporting Frequency	Disaggregate	PMI/ AIRS Indicator	Annual Targets and Results					
						Year 1		Year 2		Year 3	
						Target	Results	Target	Results	Target	Results
environmental compliance and personal safety standards in IRS implementation	training in environmental compliance and personal safety standards in IRS implementation using AIRS Project resources, includes all staff who received environmental compliance training - spray operators, team leaders, washpersons, storekeepers, etc.		reports Reporting frequency: Each spray season	By Gender			Round 1: 884; (879 male, 5 female) Round 2: 1,147 (1,120 male, 27 female)		Female[13]; 13.0% Female		
2.2.5 Number of health workers receiving insecticide poisoning case management training	Total number of clinical personnel trained in insecticide poisoning case management using AIRS Project resources	Y2, Y3	Data source: Project records – Training reports Reporting frequency: Each spray season	By Spray Campaign By Gender	AIRS	158 (3 persons from 36 districts + 50 at national-level)	Total: 120 Round 1: 97[14] (61 males, 36 female) Round 2: 23 (18 males, 5 females)	108 (3 persons from 36 districts)	103 (85 Male, 18 Female; 17.5% Female)	108 (3 persons from 36 districts)	
2.2.6 Number of adverse reactions to pesticide exposure documented	Total number of incidents of pesticide exposure reported that resulted in a referral for medical care	Y1, Y2, Y3	Data source: Incident report forms that are required for each incidence of pesticide exposure Reporting frequency:	By Spray Campaign By residential/ occupational exposure	AIRS	0	0	0	0	0	

[11] Summation of Spray Operators (1255), Squad Leaders (315), Team Leaders (74) and porters (315), storekeepers (36), store assistance (36); See Annex B, Table 3 for 2012 training results.
[12] Summation of Spray Operators (1255), Squad Leaders (315), Team Leaders (74), and porters (315), storekeepers (36), store assistance (36) and Washers (93)
[13] Summation of Spray Operators (1,492; 1490 male, 2 female), Squad Leaders (492; 254 male, 238 female), Team Leaders and Supervisors (86; 85 male, 1 female), porters (373; 361 male, 12 female); store keepers (36 ; 33 male, 3 female), store assistants (38 ; 28 male, 8 female) and washers (71; 0 male, 71 female),
[14] Round 1 trainings included training of national-level personnel.

Performance Indicator	Indicator Definition	Project Year(s) Reporting	Data Source(s) and Reporting Frequency	Disaggregate	PMI/ AIRS Indicator	Annual Targets and Results					
						Year 1		Year 2		Year 3	
						Target	Results	Target	Results	Target	Results
			Each spray season								
2.2.7. Number of vehicular accidents reported	Total number of vehicular accidents reported	Y1, Y2, Y3	Data source: Vehicular incident report forms that are required for each accident Reporting frequency: Each spray season	By Spray Campaign	AIRS	0	0	0	1 Guliso District	0	
2.3 Support Entomological Monitoring Activities and Insecticide Resistance Strategies											
2.3.1 Number of entomological sentinel sites[15] supported by the AIRS project	Total number of entomological sentinel sites supported by the AIRS project	Y1, Y2, Y3	Data source: Entomological reports Reporting frequency: Annually	By Spray Campaign	AIRS	3	3	3	3	3	
2.3.2 Number and percentage of entomological monitoring sentinel sites measuring all five primary PMI entomological indicators	*[Numerator:* Number of entomological monitoring sites measuring all five primary PMI entomological indicators] *[Denominator:* Number of entomological monitoring sentinel sites] *Calculation:* [Numerator ÷ Denominator] x 100	Y1, Y2, Y3	Data source: Entomological reports *Reporting frequency:* Annually	By Spray Campaign	AIRS	3 (100%)	3(100%)	3 (100%)	3 (100 %)	3 (100%)	
2.3.3 Number and percentage of entomological monitoring sites measuring at least	*[Numerator:* Number of entomological monitoring sites measuring at least one secondary PMI indicator]	Y1, Y2, Y3	Data source: Entomological reports	By Spray Campaign	AIRS	3 (100%)	3(100%)	3 (100%)	3 (100%)	3 (100%)	

[15] These sentinel sites collect data on mosquito behavior.

Performance Indicator	Indicator Definition	Project Year(s) Reporting	Data Source(s) and Reporting Frequency	Disaggregate	PMI/ AIRS Indicator	Annual Targets and Results					
						Year 1		Year 2		Year 3	
						Target	Results	Target	Results	Target	Results
one secondary PMI indicator	*[Denominator:* Number of entomological monitoring sites] *Calculation:* [Numerator ÷ Denominator] x 100		Reporting frequency: Annually								
2.3.4 Number and percentage of insecticide resistance testing sites that tested at least one insecticide from each of the four classes[16] of insecticides recommended for malaria vector control	*[Numerator:* Number of insecticide resistance testing sites that tested at least one insecticide from each of the four classes of insecticides recommended for malaria vector control.] *[Denominator:* Number of insecticide resistance testing sites] *Calculation:* [Numerator ÷ Denominator] x 100	Y1, Y2, Y3	Data source: Entomological reports Reporting frequency: Annually	By Spray Campaign By Type of Insecticide	AIRS	5	5 sites; All 4 classes of insecticides tested at all 5 sites; 100%	5 (100%)	5 sites; All 4 classes of insecticides tested at all 5 sites; 100%	5 (100%)	
2.3.5 Number of wall bioassays conducted within 2 weeks of spraying to evaluate the quality of IRS	Total number of wall bioassay studies conducted in established sentinel sites to evaluate quality of IRS spraying activities	Y1, Y2, Y3	*Data source:* Entomological reports *Reporting frequency:* Per spray campaign	By Spray Campaign	PMI	30 (3 sentinel sites with 10 houses each)	Round 1: 10 (1 sentinel sites with 10 houses) Round 1: 20 (2 sentinel sites with 10 houses each[17])	20 (2 sentinel sites with 10 houses each)	80[18]	70	

[16] The 4 classes of insecticide are1) carbamates 2) organochlorides 3) organophosphates and 4) pyrethroids

[17] 1 sentinel site was located in Kersa, the site of the community based IRS pilot.

[18] 8 sentinel sites; 1 in each of the 6 community-based IRS districts and as well as a site in Omo Nada and a site in Gobu sayo districts. Each sentinel site contains 5 houses and each house had two different wall bioassay test conducted. One test with wild reared mosquitos and one with lab reared susceptible mosquitos.

Performance Indicator	Indicator Definition	Project Year(s) Reporting	Data Source(s) and Reporting Frequency	Disaggregate	PMI/ AIRS Indicator	Annual Targets and Results					
						Year 1		Year 2		Year 3	
						Target	Results	Target	Results	Target	Results
2.3.6 Number of wall bioassays conducted after the completion of spraying at monthly intervals to evaluate insecticide decay	Total number of wall bioassay studies conducted at monthly intervals in established sentinel sites to evaluate the rate of insecticide decay on sprayed surfaces	Y1, Y2, Y3	*Data source:* Entomological reports *Reporting frequency:* Per spray campaign	By Spray Campaign	PMI	120; 30 houses tested at months 0.1. 2. 3	Total: 120 Round 1: 40 (10 houses tested at months 0,1,2,3) Round 2: 80 (10 houses tested at months 0,1,2,3)	80; 20 houses tested at months 0, 1, 2, 3	On process at time of MEP update	80	
2.3.7 Number of vector susceptibility tests for different insecticides conducted in selected sentinel sites	Total number of vector susceptibility tests conducted to gauge the effectiveness of individual insecticides proposed for use in spray operations	Y1, Y2, Y3	*Data source:* Entomological reports *Reporting frequency:* Per spray campaign	By Type of Insecticide	PMI	20	56 tests conducted in 5 sites[19]	20	On progress[20]	35	
2.4 Conduct Communications Activities and Community Mobilization											
2.4.1 Number of radio spots and talk shows aired	Total number of radio spots and talk shows aired in target spray districts to stress the safety and benefits of IRS, ensure successful spray coverage, timely vacating of premises and adherence to IRS safety precautions by community members	Y1, Y2, Y3	Data source: Project records Reporting frequency: Semi-annually	By Spray Campaign	AIRS	N.A.	0	2 radios spots in Amharic and Oromiffa.	2 languages, 40 spots each, 80 spots total	N.A. Radio spots will not be used in Year 3	

[19] Permethrin=1; Propoxur=11; Malathin=5; Lambdacyhalothrin=1; Fenitrothion=8; Etofenoprox=2; DDT=5; Bendocarb=8; Deltametrin=11; Alphacypermethrin=2; Prymiphosmethyl=2

[20] Expected result: 52 tests; Permethrin=3, Propoxur=6, Malathin=6, Lambdacyhalothrin=4, Fenitrothion=5, Etofenprox=2, DDT=6, Bendocarb=6, Deltametrin=6, Alphacypermethrin=2, Prymiphos methyl=6

Performance Indicator	Indicator Definition	Project Year(s) Reporting	Data Source(s) and Reporting Frequency	Disaggregate	PMI/ AIRS Indicator	Annual Targets and Results					
						Year 1		Year 2		Year 3	
						Target	Results	Target	Results	Target	Results
2.4.2 Number of IRS print materials disseminated	Total number of IRS educational materials developed, printed and distributed to community members in target spray districts using AIRS Project resources	Y1, Y2, Y3	Data source: Project records Reporting frequency: Semi-annually	By Spray Campaign By Type of printed material and message(s)	AIRS	N.A.[21]	Total: 304,000; 300,000 flyers; 4,000 posters Round 1: 158,651; 157,651flyers; 1000 posters; Round 2: 145,349; 142,349 flyers; 3000 posters	N.A.	N.A.	N.A.	
2.4.3 Number of people reached with IRS messages via door-to-door mobilization	Total number of adults reached with IRS message during pre-spray community, door-to-door mobilization	Y1, Y2, Y3	Data source: Mobilization Data Collection Forms Reporting frequency: Daily per mobilization conducted	By Spray Campaign By Gender	AIRS	750,000 (50% of the target population of 1,500,000 million)	Total: 803,130 (366,091 male, 437,039 female) Round 1: 437,677 (203,644 male, 234,033 female); Round 2: 365,453 (162,447 male, 203,006 female)	N.A	N.A.	N.A.	

[21] Specific target was not set at time of workplanning.

Performance Indicator	Indicator Definition	Project Year(s) Reporting	Data Source(s) and Reporting Frequency	Disaggregate	PMI/ AIRS Indicator	Annual Targets and Results					
						Year 1		Year 2		Year 3	
						Target	Results	Target	Results	Target	Results
2.5 Spray Targeted Structures According to Technical Specifications											
2.5.1 Number of structures targeted for spraying[22]	Total number of structures found in targeted spray districts by Spray Operators	Y1, Y2, Y3	Data source: Daily Spray Operator Forms Reporting frequency: Daily per spray campaign	By Spray Campaign	PMI	Total: 490,000 in 36 districts; 26 graduating and 10 new; Technical support for spraying of up to 512,357 additional structures in 24 graduated districts	Total: 554,063 in the 36 districts that were graduating or new; Round 1: 269,057; Round 2: 285,006 Graduated Districts: 520,149	Total: 550,000 unit structures in 36 districts; Technical support to IRS operations in 24 graduated districts spraying approximately 500,000 structures	638,173	640,000	
2.5.2 Number of structures sprayed with IRS[23]	Total number of structures sprayed in targeted districts where spraying was conducted	Y1, Y2, Y3	Data source: Daily Spray Operator Forms Reporting frequency: Daily per spray campaign	By Spray Campaign	PMI	Total in36 districts: 416,500 24 Graduated Districts: 435,503	Total in36 districts: 547,421; Round 1: 265,106; Round 2: 282,315 24 Graduated Districts: 428,459	467,500	635,528	544,000	

[22] The yearly targets for this indicator are from the applicable workplan, in this way the variation in targeted spray areas from year-to-year can be taken into account. The yearly results are the number of structures found by spray operators during the spray campaign.
[23] The target per year for this indicator is based on 85% of the number of structures to be targeted as noted in indicator 2.5.1.

Performance Indicator	Indicator Definition	Project Year(s) Reporting	Data Source(s) and Reporting Frequency	Disaggregate	PMI/ AIRS Indicator	Annual Targets and Results					
						Year 1		Year 2		Year 3	
						Target	Results	Target	Results	Target	Results
2.5.3 Percentage of total structures targeted for spraying that were sprayed with a residual insecticide (Spray Coverage)	[Numerator: Total number of structures sprayed in targeted districts] [Denominator: Total number of structures in targeted areas found by spray operators] Calculation: [Numerator ÷ Denominator] x 100	Y1, Y2, Y3	Data source: Daily Spray Operator Forms Reporting frequency: Daily per spray campaign	By Spray Campaign	PMI	85% per campaign	Total: 99.8%; Round 1: 98.8 %; Round 2: 99.1% Graduated Districts: 82%	85%	99.6%	85%	
2.5.4 Number of people residing in structures sprayed (Number of people protected by IRS)	Total number of people residing in structures sprayed (Actual numbers are collected during spray operations; population estimates are not used.)	Y1, Y2, Y3	Data source: Daily Spray Operator Forms Reporting frequency: Daily per spray campaign	By Spray Campaign By Number of pregnant women By Number of children <5 years old	PMI	1,500,000	Total: 1,506,273; Round 1: 698,898, including 12,571pregnant women and 105,769 children under 5; Round 2: 807,375, including 10,737 pregnant women and 120,106 children under 5 Graduated Districts: 1,433,812	1,500,000	1,629,958 including 25,211 pregnant women and 240,558 children under 5	1,629,958	

Performance Indicator	Indicator Definition	Project Year(s) Reporting	Data Source(s) and Reporting Frequency	Disaggregate	PMI/ AIRS Indicator	Annual Targets and Results					
						Year 1		Year 2		Year 3	
						Target	Results	Target	Results	Target	Results
Component 3: Provide ongoing monitoring and evaluation and quality control measures											
3.1 Submit Monitoring and Evaluation Plan (MEP) to PMI-Ethiopia[24]	*Milestone:* (Completed/Not Completed)	Y1, Y2, Y3	Data source: Project records Reporting frequency: Semi-annual		AIRS	Complete d	Completed	Completed	Completed	Complete d	
3.2 Submit a post-spray data quality audit (PSDQA) report to the AIRS M&E specialist in the home office within 60-180 days of completion of spray operations	*Milestone*: (Completed/Not Completed)	Y1, Y2, Y3	Data source: Spray operations reports Reporting frequency: Per spray campaign	By Spray Campaign	AIRS	N.A. – AIRS Ethiopia has been chosen to carry out the PSDQA in Year 2	N.A.	Completed	On-process	N.A.	
3.3 Submit a country-specific Eligible Structure Definition Document to local PMI advisors and NMCP	*Milestone:* (Completed/Not Completed)	Y1	Data source:: Project records Reporting frequency: Semi-annually		AIRS	Complete d	Completed	N.A.	N.A.	N.A.	N.A.
3.4 Supply chain review conducted by RTT	Milestone: (Completed/Not Completed)	Y1, Y2	Data source: RTT supply chain review reports Reporting frequency: Semi-annually	By Spray Campaign	AIRS	Complete d	Completed	N.A.	N.A.	N.A.	

[24] MEP matrix updated and submitted with Year 2 and Year 3 work plans and EOSRs.

Performance Indicator	Indicator Definition	Project Year(s) Reporting	Data Source(s) and Reporting Frequency	Disaggregate	PMI/ AIRS Indicator	Annual Targets and Results					
						Year 1		Year 2		Year 3	
						Target	Results	Target	Results	Target	Results
Component 4: Contribute to Global IRS Policy-Setting and Country-Level Policy Development of Evidence-Based IRS; Disseminate Experiences and Best Practices											
4.1 Number of guidelines/checklists/tools related to IRS operations developed or refined with project support	Total number of implementation guidelines, process checklists and program tools related to IRS operations developed or refined using the technical and/or financial resources of the AIRS Project	Y1, Y2, Y3	Data source: Project records – Activity reports Reporting frequency: Semi-annually	By Guideline/ checklist/tool	AIRS	N.A.	8[25]	7	7[26]	TBD	
4.2 Number of articles/best practices documents published	Total number of articles or other best-practice documents that have been published in relevant journals or through PMI/USAID communications vehicles	Y2, Y3	Data source: Project records – Activity reports Reporting frequency: Semi-annually	By Spray Campaign By IRS Technical Area	AIRS	N.A.	N.A.	TBD	1[27]	TBD	
4.3 Number of best practice presentations given at national/ regional/international workshops and conferences	Total number of project-related oral and poster presentations delivered in national, regional and/or international meetings related to IRS.	Y2, Y3	Data source: Project records – Activity reports Reporting frequency: Semi-annually	By IRS Technical Area	AIRS	N.A.	1 – Ethiopia Presentation by Dr. Yemane on Communitiy-based IRS in Kersa District	TBD	2[28]	1	

[25] 1) Mobilization Supervision Checklist; 2) Spray Operation Supervision checklist; 3) Field Data Verification Checklist; 4) Record and System Assessment Checklist; 5) Indicator Definition Guideline; 6) Mobilization Data Collection Tools; 7) Spray Operations Data Collection Tools; 8) Spray Operations Daily tracker

[26] 1) Mobile Environmental Compliance Forms via smart phone application, 2) Error Eliminator, 3) Data Collection Verification Form, 4)Data Entry Verification Form, 5) IRS Supervision Checklist, 6).Data Entry Center Supervision Checklist 7) AIRS Access Database Cleaning/Reporting Tool

[27] Article on AIRS/PMI collaboration with Jimma University on molecular entomological capacity building published at http://www.africairs.net/2013/09/jimma-university-becomes-first-institution-in-ethiopia-to-carry-out-molecular-entomology/

[28] Presentations on Communitiy-based IRS in Kersa District presented by Dr. Yemane in Durban, South Africa at the 2013 Multilateral Initiative on Malaria Conference and by Dereje at the 2013 American Society of Tropical Medicine and Hygiene (ASTMH) Conference, Washington, DC.

Performance Indicator	Indicator Definition	Project Year(s) Reporting	Data Source(s) and Reporting Frequency	Disaggregate	PMI/ AIRS Indicator	Annual Targets and Results					
						Year 1		Year 2		Year 3	
						Target	Results	Target	Results	Target	Results
Component 5 (Cross-cutting): Capacity Building, Knowledge Transfer, Gender Inclusion											
5.1 Capacity Building (Gender Inclusion)											
5.1.1 Number of people trained in IRS implementation[29]	Total number of personnel trained in IRS implementation using AIRS Project resources. This figure only includes spray personnel such as spray operators, team leaders, supervisors, clinicians; it excludes data clerks, IEC mobilizers, drivers, washers, porters, pump technicians, security guards, etc.	Y1, Y2, Y3	Data source: Project records – Training reports Reporting frequency: Semi-annually	By Spray Campaign By Gender Percentage of Women Trained	PMI	2,166[30]	Total: 2260[31] (2177 male, 83 female; 3.7% female) Round 1: 1058 (1,011 male, 47 female; 4.4% female) Round 2: 1202 (1,166 male, 36 female; 3.0% female)	2361	2,684 (2,404 Male, 280 Female; 10.4% Female)	2,684	
5.1.2 Number of people trained to deliver or support IRS in target districts	Total number of people trained using AIRS Project resources to implement/support elements of IRS in target districts. This figure includes all cadres that serve a role in IRS.	Y1, Y2, Y3	Data source: Project records – Training reports Reporting frequency: Semi-annually	By Spray Campaign By Gender By Role (e.g., spray operator, storekeeper) Percentage of	AIRS	4269[32]	Total: 4,213[33]; (3,221 male, 992 female; 23.5% female) Round 1: 2,005 (1,533 male, 472 female; 23.5% female) Round 2: 2,208	3953	3,987(2,915 Male, 1,072 Female; 26.9% Female)	3,987	

[29] This indicator is sometimes termed "Number of people trained to deliver IRS

[30] Summation of planned training numbers for TOT trainings at national (50), regional (198), zonal and district levels (50) and spray personnel trainings - spray operators (1480) and team and squad leaders (388). See Annex B of 2012 EOSR, Table 2 for training plan details.

[31] See Annex B of 2012 EOSR, Table 4 for training details.

[32] From 2012 AIRS Ethiopia workplan budget.

[33] See Annex B of 2012 of EOSR, Table 3 for details on 2012 training results

Performance Indicator	Indicator Definition	Project Year(s) Reporting	Data Source(s) and Reporting Frequency	Disaggregate	PMI/ AIRS Indicator	Annual Targets and Results					
						Year 1		Year 2		Year 3	
						Target	Results	Target	Results	Target	Results
				women trained			(1688 male, 520 female; 23.6% female)				
5.1.3 Number of personnel trained as IRS implementation trainers	Total number of personnel trained in Training of Trainers (TOT) for IRS delivery	Y1, Y2, Y3	Data source: Project records – Training reports Reporting frequency: Semi-annually	By Spray Campaign By Gender Percentage of women trained	AIRS	270[34]	Total: 255[35](242 male,13 female; 5.1% female) Round 1: 149 (142 male, 7 female; 4.7% female) Round 2: 106 (100 male, 6 female; 6% female)	285	268 (249 Male, 19 Female; 7.1% Female)	268	
5.1.4 Number of government environmental and/or health officials trained in IRS oversight	Total number of national and sub-national/district government environmental and/or health officials who are trained in oversight of IRS implementation using AIRS Project resources	Y1, Y2, Y3	Data source: Project records – Training reports Reporting frequency: Semi-annually	By Spray Campaign By Gender Percentage of Women Trained Type of government official (e.g. environmental/	AIRS	160	Total: 160[36] (158 male, 2 female; 1.3% female) Round 1: 87 (86 male,1 female; 1.1% female) Round 2: 73 (72 male, 1 female; 1.4% female)	160	224 (214 Male, 10 Female; 5.4% Female)	224	

[34] From 2012 AIRS Ethiopia workplan budget.
[35] Summation of National (32) and Regional-level (223) TOT on Comprehensive IRS. See Annex B of 2012 EOSR, Table 3 for details on 2012 training results.
[36] 255 government personnel received comprehensive TOT with only 160 of them to serving as IRS implementation supervisors, the remainder served in other roles such as mobilization supervision, etc.

Performance Indicator	Indicator Definition	Project Year(s) Reporting	Data Source(s) and Reporting Frequency	Disaggregate	PMI/ AIRS Indicator	Annual Targets and Results					
						Year 1		Year 2		Year 3	
						Target	Results	Target	Results	Target	Results
				health)							
5.1.5 AIRS Ethiopia conducted a capacity assessment	AIRS Ethiopia program conducted an assessment of IRS capacity among national and sub-national/district government health officials	Y1, Y2	Data source: Project records – Capacity assessment reports Reporting frequency: Semi-annually		AIRS	Completed	Pending	Completed	On-Process	N.A.	
5.1.6 Number of capacity-building MOUs signed by AIRS, NMCP and partners/ institutions	Total number of Memoranda of Understanding (MOU) on provision of local capacity building finalized and signed between AIRS, the National Malaria Control Program, and other local partners and institutions	Y1, Y2, Y3	Data source: Project records – MOUs Reporting frequency: Semi-annually	By Spray Campaign	AIRS	N.A.	N.A.	1[37]	2[38]	N.A.	

[37] MOU planned with Jimma University to enhance local capacity for entomological research.
[38] Entomological capacity building MOU signed with Jimma and Mekelle Universities