



PRESIDENT'S MALARIA INITIATIVE



# The PMI Africa IRS (AIRS) Project

## Indoor Residual Spraying (IRS) Task Order Four & Indoor Residual Spraying Task Order Six

# SEMI-ANNUAL REPORT

OCTOBER 1, 2014 – MARCH 31, 2015

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*The views expressed in this document do not necessarily reflect the views of the United States Agency for International Development or the United States Government.*



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# ACRONYMS

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<b>AIRS</b>	Africa Indoor Residual Spraying Project
<b>CDC</b>	Centers for Disease Control and Prevention
<b>COP</b>	Chief of Party
<b>COR</b>	Contracting Officer's Representative
<b>DfID</b>	Department for International Development
<b>DDT</b>	Dichlorodiphenyltrichloroethane
<b>EC</b>	Environmental Compliance
<b>ECO</b>	Environmental Compliance Officer
<b>EEM</b>	Enhanced Entomological Monitoring
<b>EIR</b>	Entomological Inoculation Rate
<b>ELISA</b>	Enzyme-Linked Immunosorbent Assays
<b>EOSR</b>	End of Spray Report
<b>EVD</b>	Ebola virus disease
<b>HLC</b>	Human Landing Catch
<b>IEC</b>	Information, Education, and Communication
<b>IRS</b>	Indoor Residual Spraying
<b>LLIN</b>	Long-lasting insecticide-treated nets
<b>M&amp;E</b>	Monitoring and Evaluation
<b>MSP</b>	Mobile Soak Pit
<b>NMCP</b>	National Malaria Control Program
<b>PMI</b>	President's Malaria Initiative
<b>PPE</b>	Personal Protective Equipment
<b>PSC</b>	Pyrethrum Spray Catch
<b>PSECA</b>	Pre-Spray Environmental Compliance Assessment
<b>SEA</b>	Supplemental Environmental Assessment
<b>SMS</b>	Short Message Service
<b>SOP</b>	Spray Operator
<b>USAID</b>	United States Agency for International Development
<b>USG</b>	United States Government
<b>WHO</b>	World Health Organization
<b>WHOPES</b>	World Health Organization Pesticide Evaluation Scheme

# EXECUTIVE SUMMARY

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During this reporting period (October 1, 2014 through March 31, 2015), the President's Malaria Initiative (PMI) Africa Indoor Residual Spraying (AIRS) Project, funded by the United States Agency for International Development, transitioned from IRS2 IQC Task Order 4 to IRS2 IQC Task Order 6. The project implemented indoor residual spraying (IRS) campaigns in Angola, Madagascar, Mozambique, Rwanda, and, for the first time, Zambia and Zimbabwe. The project covered an average of 93.4% of targeted structures, and protected more than 6.7 million people from malaria.

Details regarding all monitoring and evaluation (M&E) outcomes by country are reported in Annex B.

## *TOP-LINE RESULTS FROM IRS CAMPAIGNS, OCTOBER 2014 - MARCH 2015*

- 1,481,205 structures sprayed
- 93.4 percent average spray coverage
- 6,728,781 people protected from malaria including:
  - 265,624 pregnant women
  - 1,030,534 children under 5 years of age
- 5,294 people trained with United States government funds to deliver IRS

During the reporting period, the project also:

- Obtained required approvals and selected an incineration facility for DDT disposal in Ethiopia;
- Introduced working groups around key focus areas (gender, capacity building, cost efficiency, epidemiology, innovations, mHealth, operational research and public-private partnerships) to enhance IRS implementation in the future;
- Presented at the American Public Health Association's Annual Conference, the 63rd American Society for Tropical Medicine and Hygiene conference in New Orleans, LA, and at USAID's Global Health Mini-University;
- Continued and expanded use of smart phones for collecting operations and environmental compliance data in Angola, Benin, Ethiopia, Ghana, Madagascar, Mali, Mozambique, Rwanda, Zambia, and Zimbabwe;
- Tested the chemical performance of Mobile Soak Pits from October-December 2014, confirming the ability of the filters to substantially reduce the concentration of pesticide in wash-waters over the period of a spray campaign;
- Wrote and disseminated five success stories, two photo stories and filmed a new video on the benefits of IRS in Madagascar from the perspective of the beneficiaries; and
- Prepared and submitted two manuscripts to journals.

# I. COUNTRY HIGHLIGHTS

## I.1 ANGOLA

**TABLE I: AIRS ANGOLA AT A GLANCE**

Number of provinces covered by PMI-supported IRS in 2014	1 (Huambo)
Insecticide	Deltamethrin ( K-Othrine ) - Pyrethroid
Number of structures covered by PMI-supported IRS in 2014	14,649
Number of structures found by SOPs in 2014	16,506
2014 spray coverage	88.7%
Population protected by PMI-supported IRS in 2014	58,370 12,531 children <5 years 1,413 pregnant women
Dates of PMI-supported IRS campaign	October 7 – November 8, 2014
Length of 2014 spray campaign*	29 operational days
Number of people trained with US government funds to deliver IRS**	187

Note: \*Spraying was completed in 21 operational days; 8 days of extensive mop-up was carried out. \*\*This is based on the PMI indicator definition. It includes only spray staff such as spray operators, team leaders, supervisors, and clinicians. It excludes data clerks, IEC mobilizers, drivers, washers, porters, pump technicians, and security guards.

### PROGRAM HIGHLIGHTS

- Piloted Home Owner Preparation and Spray Operator (SOP) Supervisory Checklists on mobile phones. These mobile-based tools highlighted common errors committed by spray operators and allowed for immediate corrections.
- Implemented and improved Mobile Spray Data Collection Systems. During the 2014 spray campaign, AIRS continued to use mobile data collection and verification for spray data, which was originally piloted in 2013.

### ENTOMOLOGY

During this reporting period AIRS Angola:

- Provided entomological training in preparation for the national susceptibility study carried out from February through March 2015 for the participants drawn from nine provinces, representing the country's three main malaria eco-epidemiological endemic areas.
- Conducted entomological activities at six sentinel sites.
- Carried out the first nationally representative susceptibility study in nine provinces across the country February – March 2015. The study tested five World Health Organization Pesticide Evaluation Scheme (WHOPES)-approved insecticides, including pyrethroids, carbamates, and organophosphates.

## **I.2 BENIN**

### *PROGRAM HIGHLIGHTS*

In January, AIRS Benin's Environment Compliance Officer (ECO) performed the initial pre-inspection environmental compliance assessment (PSECA) at operating sites in all nine communes in Atacora Department. In February 2015 AIRS Benin contributed to PMI's 2016 Malaria Operational Plan (MOP) activities. AIRS Benin's contributions included highlighting the role of IRS in protecting the population from malaria transmission and the challenges facing the IRS intervention from evolving insecticide resistance, increasing operational costs, and NMCP's relatively low capacity to implement IRS directly.

On March 5, 2015, AIRS Benin submitted its Letter Report summarizing key findings from the ECO's PSECA and the project's plan to implement the project-wide Environmental Mitigation and Monitoring Plan (EMMP). Key objectives in the Letter Report were to remove fertilizers currently stored at the Kerou warehouse by the Ministry of Agriculture, strengthen environmental monitoring and risk management tools for overseeing the transportation of spray teams, and increase the local government partners' capacity in organizing, planning, implementing, and evaluating IRS campaigns.

### *ENTOMOLOGY*

- In November and December 2014, the Entomological Research Center of Cotonou conducted entomological surveillance six and seven months after the IRS campaign. The residual effect of the insecticide applied was assessed in Tanguieta and Natitingou communes. Four months after the IRS campaign, the mortality rate was below the minimum criteria for effectiveness (80% mortality of exposed mosquitoes) for both EC and CS formulations of pirimiphos-methyl, on both mud and cement walls.

### *EPIDEMIOLOGY*

- AIRS Benin completed its study on the quality of Benin's health management information system (HMIS) malaria incidence data for making evidence-based decisions in malaria program management.
- AIRS Benin partnered with a World Bank-funded health systems strengthening (HSS) project, which collects and improves health facility data across eight health zones in Benin and disaggregates malaria incidence data by pregnant women and children under 5. AIRS Benin and the HSS project agreed to share the HSS project's malaria incidence data from four districts in northern Benin, including three IRS spray districts (i.e. Kerou, Kouande, and Pehunco in Atacora Department).

## **I.3 BURUNDI**

### *PROGRAM HIGHLIGHTS*

AIRS Burundi provided technical assistance to specific-country malaria prevention activities in alignment with the National Malaria Strategic Plan (2013-2017) in planning and carrying out entomological surveillance activities in the field. During this reporting period, AIRS Burundi increased the number of sentinel sites from six to eight to ensure good coverage in national entomological surveillance and trained 16 additional technicians who will support the entomological monitoring activities in these sites.

With AIRS Burundi's support, a functional entomology laboratory and an insectary were maintained to help with the monitoring of vector control interventions. Eight entomological surveillance sites, covering the various malaria epidemiological patterns (facies), were regularly surveyed to collect data on entomological indicators.

AIRS Burundi provided support in the purchasing of local and international supplies needed to optimize entomological surveillance activities. The project assisted the NMCP in the coordination of entomological surveillance activities and in the strengthening, training, and monitoring of local technicians. AIRS Burundi led the training of the field technicians assigned to the sentinel sites.

### *CHALLENGES AND LESSONS LEARNED*

- Sustained effort in terms of supervision of all sites will be needed to help the new technicians to acquire the skills required to conduct entomological surveillance activities properly.
- The inadequate number of staff at the health centers that host the sentinel sites could result in the technicians being used for health center activities, thereby slowing the pace of entomological surveillance activities.

## **I.4 DEMOCRATIC REPUBLIC OF CONGO**

### *PROGRAM HIGHLIGHTS*

AIRS Democratic Republic of the Congo signed a subcontract with the National Institute of Biomedical Research to implement Enhanced Entomological Monitoring (EEM) activities in seven sentinel sites. EEM activities include PSC and HLC collections and insecticide susceptibility testing.

HLCs and PSCs were carried out in six sentinel sites: Lodja, Kabondo, Kalemie, Kapolowe, Katana, and Kingasani.

## **I.5 ETHIOPIA**

### *PROGRAM HIGHLIGHTS*

AIRS Ethiopia produced an evaluation report on the 2014 community-based spray operations that was reviewed by PMI leadership. The selection of the incineration facility for the DDT disposal was finalized. The team completed negotiations with the incineration partner and is currently in the process of establishing a contract. A central storage facility near Addis Ababa was identified and training and subsequent movement of the obsolete DDT was planned for September 2015.

AIRS Ethiopia assisted with organizing a country consultation to review the Global Malaria Action Plan (GMAP) 2. The consultation was convened by the National Malaria Program of the Federal Ministry of Health. Forty participants from various stakeholder groups took part in the consultation held on November 14th in Nazareth.

At the request of PMI Ethiopia, the country program co-funded and co-facilitated workshops on operational research and monitoring and evaluation to improve data collection and reporting for evidence-based decision making. Participants included those from research institutions and universities collaborating with projects funded by the United States Government (USG).

AIRS Ethiopia facilitated an endorsement by the State Minister of Health to pilot a new class of insecticide (organophosphate) in PMI-supported districts in 2015. The team developed a number of concept notes to explain the importance of the new insecticide and a trial in a small area to inform the national strategy for insecticide resistance management.

### *ENTOMOLOGY*

- The decay rate of bendiocarb was monitored for four consecutive months after spraying. The residual life of bendiocarb was shown to be variable for different wall surfaces. On the dung, plastic, and painted surfaces, the residual bio-efficacy of bendiocarb lasted approximately four months. On mud surfaces, it lasted only up to one month. AIRS Ethiopia selected two

intervention (sprayed) sites and one control (not sprayed) site to collect data on vector behavior and density.

- AIRS Ethiopia conducted training in Adama, March 23 – 26, 2015, in basic entomology for Federal Ministry of Health staff selected from all regions. A total of 35 malaria focal persons attended the training.
- The susceptibility of the main malaria vector in Ethiopia, *An. gambiae* s.l., was tested against 11 WHOPES-approved insecticides for IRS use. Testing using the WHO tube assay in four of seven sites was completed in December 2014.
- The CDC bottle assay test was conducted using five insecticides in five districts out of 21. The mortality test results of *An. gambiae* s.l were: DDT (0-88.9%), permethrin (30-88.9%), deltamethrin (20-73.7%), bendiocarb (90-100%), and propoxur (95-100%).

## 1.6 GHANA

### PROGRAM HIGHLIGHTS

AIRS Ghana conducted capacity building workshops for NMCP and District Assembly staff across the Upper East, Upper West, and Northern regions. A total of 200 participants were introduced to IRS planning, implementation, and monitoring and evaluation (M&E).

USAID/Ghana conducted a data quality assessment of the AIRS Ghana program. The purpose was to ensure that the mission was aware of the data strengths and weaknesses and the extent to which the data can be trusted to influence management decisions. The focus was on the M&E plan, data collection methods, tools, data entry, data flow plan, data quality assurance, controls, security systems, and the PMI core indicators. During the verification of the data, the USAID team did not find any inconsistencies.

The project conducted a Pre-Season Environmental Assessment in February, and provided a list of recommendations for improvement. The entire 16 operational sites were rehabilitated in preparation for 2015 operations.

The project together with PMI and NMCP selected five operational sites (one from each district) to pilot bio-monitoring in the 2015 spray campaign. In a training facilitated by GEMS expert, Dr. Matthew Keifer, a total of 27 people were trained as supervisors, data clerks, laboratory technicians/clinicians to conduct the bio-monitoring tests and analyze the data.

AIRS Ghana carried out pre-spray stakeholder meetings in mid-March with the objective of increasing engagement of local leadership in spray operations. As a result of the meetings, the project agreed to share spray plans with District Assemblies, and to have emissaries nominated by the chiefs who will accompany the spray teams during the 2015 IRS campaign and give daily feedback to their respective chiefs on the progress of spray activities in their communities.

The project launched an IEC campaign with the theme *Gain Access to Every Structure* to inform communities and their leadership about IRS and its benefits, and to address concerns and misconceptions. The campaign, which was carried out in all PMI IRS districts, used various platforms including religious venues (churches and mosques), health outpatient departments and ante-natal visits, school visits, trader/women/farmer/youth group meetings, and door-to-door campaigns. Chiefs were also visited and informed about upcoming IRS activities.

### ENTOMOLOGY

- Monthly entomological monitoring was conducted across four districts between October 2014 and March 2015. Results from the surveys conducted during this time showed reduced vector density, biting rates, and parity in the PMI-supported IRS districts. Monthly wall bioassays

showed that the sprayed insecticide (Actellic 300 CS) remained efficacious in killing local vectors up to seven months after IRS. The decay rate was monitored until percentage mortalities in tests stayed below the acceptable threshold of 80 percent.

- The Innovative Vector Control Consortium conducted a training on the Disease Data Management System, February 9-12, 2015, in Tamale. The database supports malaria data entry and storage and helps to produce reports and visual maps.

## 1.7 LIBERIA

### PROGRAM HIGHLIGHTS

- Since the Ebola virus disease (EVD) outbreak, AIRS Liberia has been without an in-country entomologist to organize and mentor the NMCP's entomology team. Similarly, local and donor resources have been concentrated on controlling the EVD outbreak, thereby increasing demands on already limited availability for NMCP technicians to travel to conduct their entomology work and report data in a timely manner. With the EVD outbreak under relative control, the PMI AIRS Project recruited and identified a candidate to replace AIRS Liberia's full-time in-country entomologist.
- Entomological monitoring was carried out in two sentinel sites. One of the sites, Tomato Camp, was sprayed in 2013 but was not sprayed in 2014, and the other site, Frank Town, was last sprayed in October 2012.
- Insecticide susceptibility tests were also carried out against *An. gambiae* s.l. using the standard WHO tube test in October and November 2014. *An. gambiae* s.l. was susceptible to fenitrothion (100%, 24 hrs mortality) and bendiocarb (98-99%, 24 hrs mortality), but the vector was resistant to deltamethrin (65% mortality) and DDT (29% mortality).

## 1.8 MADAGASCAR

**TABLE 2: AIRS MADAGASCAR AT A GLANCE**

	CHL (Focal)	East of Madagascar (Blanket)	Total
Number of districts sprayed by PMI-supported IRS in 2014-2015	6 (Ambositra, Ambohimahaso, Faratsiho, Manandriana, Fandriana)	3 (Brickaville, Tamatave II and Fenerive Est)	9
Insecticide	Carbamates and pyrethroids	Organophosphates	
Number of structures sprayed by PMI-supported IRS	125,125	149,408	274,533
Number of structures targeted by PMI-supported IRS	128,922	158,006	286,928
Spray coverage	97.1%	94.6%	95.7%
Total population protected by PMI-supported IRS	749,965	557,419	1,307,384
Pregnant women protected	13,706	16,665	30,371
Children under 5 protected	109,361	65,853	175,214
Dates of PMI-supported IRS campaign	Nov 3, 2014 – Dec 10, 2014	Sept 8, 2014 – Nov 6, 2014	
Length of Campaign	33	51	
Number of people trained with USG	440	369	809

## PROGRAM HIGHLIGHTS

- AIRS Madagascar piloted an mHealth system to monitor operational results daily. This information was used to manage problems as they arose and ensure high quality spraying. The use of the mHealth operational data collection and the daily debriefing via Skype were both instrumental in improving operations monitoring and supervision, especially in the East where the team needed to closely watch spray progress.
- After the spray campaign, a post-spray data quality assurance was conducted in the East and CHL. Audit data showed that in the East 91.08% (88.38%; 93.20%) of eligible structures found by spray operators were sprayed during the 2014 campaign as compared to the 94.56% spray coverage reported during the 2014 IRS campaign. In the CHL, audit findings show 97.29% (94.53; 98.68) of structures sprayed as compared to 97.05% spray coverage reported.

## ENTOMOLOGY

- Cone bioassay tests conducted during the first week of the IRS campaign revealed that the quality of spraying was good (100% test mortality) in all the IRS areas and that the insecticide used during the IRS campaign was effectively killing mosquitoes.
- Distribution of vector species varied considerably between sentinel sites: a higher number of anopheline species were found in sentinel sites located in the East compared to sentinel sites in the CHL. *Anopheles funestus* was not found in the mosquitoes collected from the CHL. *An. gambiae* s.l., identified as *An. arabiensis*, was the only vector species collected at three sentinel sites in the CHL: Milamaina (17.6%), Imerina Imady (17.9%) and Ankafina Tsarafidy (7.3%). In the fourth sentinel site (Vohimarina), the vector species collected were *An. arabiensis* (4.6%) and *An. mascariensis* (0.7%).
- Vector human biting rates were lower in the CHL than the East. The indoor resting density collected using PSC was very low in all the sentinel sites, both at the baseline and post spraying.
- Susceptibility testing shows that *Anopheles gambiae* s.l. has developed resistance to DDT in Imerina Imady and Vohimarina and to permethrin in Mahambo in the East and in Bekily in the South. Possible resistance was observed in the eastern sites to deltamethrin in Vohitrambato and Vavatenina, to permethrin in Vohitrambato, Ambodifaho, and Vavatenina, and to alpha-cypermethrin in Imerina Imady, Bekily, and Mahambo. This resistance is probably due to the wider use of LLINs for several years in these sites with the exception of Imerina Imady, where the NMCP did not conduct LLIN distribution, but rather IRS with pyrethroid for the past several years.

## CHALLENGES AND LESSONS LEARNED:

- Mobile soak pits were used in 23 sites in the East (Fenerive Est: 6, Toamasina: 10, Brickaville: 7) and 28 sites in the CHL (Fianarantsoa: 6, Fandriana: 7, Faratsiho: 5, Ambositra: 6, Ambohimahasoa: 4). They saved considerable cost and time and helped to further improve the quality of spray operators' work.
- Since farming and inaccessibility can potentially be a challenge in implementing IRS in certain areas, AIRS should collaborate with local authorities to identify these issues in the planning and targeting stages of IRS and collectively decide on a solution.
- The project should revise IEC/BCC mobilization strategies in the district of Fenerive Est to work closely with local leaders to motivate people and change their views about IRS.

- AIRS Madagascar needs to manage their insecticide stock more carefully in the future, to prevent expiration of insecticides.

## 1.9 MALI

### PROGRAM HIGHLIGHTS

- Upon request from PMI Mali, AIRS Mali with the help of a consultant developed the 2016-2020 National Strategic Plan for IRS.
- The team developed a protocol for epidemiological surveillance to use existing health facility data to perform trend analysis to determine if it is possible to see an effect of IRS on the number of suspected and confirmed malaria cases in PMI-supported IRS areas.

### ENTOMOLOGY

- In October, the project analyzed the insecticide resistance data collected in August and September after the spray campaign. The results indicated a high level of intensity of resistance to permethrin and deltamethrin. The level of intensity of resistance was heterogeneous among study areas and between the two insecticides tested.
- Quality assurance tests conducted in three IRS-targeted districts showed that the quality of spraying was good and homogeneous. Four months after spraying, test mortality rates dropped below 80% in both Baraoueli and Bla districts, indicating about three months of residual life for Actellic 300 CS in those districts.
- AIRS Mali continued working on the Combination LLINs and Piperonyl Butoxide (PBO) Study. The project completed data collection under the 2014 work plan in December and initiated bi-monthly data collections for 2015 in February. PMI recommended continuation of the study based on the analysis of results from 2014 entomological monitoring.

### CHALLENGES AND LESSONS LEARNED

- For the epidemiological survey, data quality audits will be required. Selection of facilities with validated and confirmed data quality will ensure that the survey results are reliable and reflect the actual effect of IRS.
- The owner of a central warehouse that the project rented out in Segou decided to use the warehouse for another use. After extensive search, AIRS Mali has finally found a new large store in Segou for the 2015 spray campaign.
- The recruitment process for the net study lead has been challenging and at the time of submission the team was still identifying appropriate candidates skilled with analytical and writing skills in addition to knowledge of mosquito collection techniques. As a result, the project entomologist has been managing the data collection process to date.

## 1.10 MOZAMBIQUE

**TABLE 3: AIRS MOZAMBIQUE AT A GLANCE**

Number of provinces/districts covered by PMI-supported IRS in 2014	5 districts in Zambézia province (Mopeia, Milange, Morrumbala, Mocuba, and Quelimane)
Insecticide	Pyrethroid
Number of structures sprayed by PMI-supported IRS in 2014	445,118

Number of structures targeted by PMI-supported IRS in 2014 (found by Spray Operators)	477,930
2014 spray coverage	93.1%
Population protected by PMI-supported IRS in 2014	2,327,815 159,830 pregnant women 404,707 children under 5
Dates of PMI-supported IRS campaign	October 20—December 13, 2014
Length of IRS campaign	48 days
Number of people trained with US government funds to deliver IRS*	1,354**

Note: \*This is based on the PMI indicator definition. It includes only spray staff such as spray operators, team leaders, supervisors, and clinicians. It excludes data clerks, IEC mobilizers, drivers, washers, porters, pump technicians, and security guards. \*\*1,308 spray operators, team leaders and base supervisors, 24 clinicians, and 22 supervisors and government staff attended the full IRS Training of Trainers.

### PROGRAM HIGHLIGHTS

Due to heavy flooding in Zambezia province in the months of January and February 2015, the Post Survey Quality Assurance was cancelled, and the end of spray evaluation meeting was not conducted until March 31, 2015. As a result of that meeting, it was agreed between the Ministry of Health, PMI, and Abt to spray five districts in 2015, including Derre, Milange, Molumbo, Morrumbala, Mocuba, and Quelimane. (Note that Milange and Morrumbala were each split into two districts in late 2014 by the Government of Mozambique. Derre was part of Morrumbala District and Molumbo was part of Milange District.) Additionally, AIRS Mozambique provided technical and logistical assistance to the Provincial Health Directorate.

Additionally, AIRS Mozambique provided technical and logistical assistance to the Provincial Health Directorate.

### ENTOMOLOGY

- Spray quality was tested within two weeks of the onset of spraying in all spray districts. Monthly insecticide decay testing was carried out through March 2015. Overall mortality rates were above 80% five months post spraying in Mocuba, Milange, Morrumbala, and Mopeia. Additional bioassays were also carried out in Mopeia where Tagros deltamethrin was sprayed in December 2014, and the mortality was over 80% three months after spraying.
- The project continued to support the NMCP's entomology activities throughout the country in 17 sentinel sites. The NMCP is conducting susceptibility testing in a continued effort to monitor insecticide resistance. Support includes provision of nearly 100% of all insecticide impregnated papers, supplies, fuel, and per diem for the field work.

### CHALLENGES AND LESSONS LEARNED

- During supervisory field visits, staff found that some SOPs were not recording unsprayed structures. Most SOPs would revisit these structures the same day to spray the structure and it would be marked as sprayed; however, a few SOPs neglected to record the structure if the house was still closed when they returned the second time, resulting in a lower than expected number of eligible structures found. To ensure this is not repeated, unsprayed structure marking will be emphasized during SOP training, and supervisors will ensure marking and recording of sprayed and unsprayed structures happens consistently throughout the spray campaign.
- As reported in previous years, some SOPs were found to be forging spray data, specifically in Mocuba, resulting in SOP dismissal and an audit of the data previously reported. Field and site

supervision was reinforced, and spraying monitored more closely on a daily basis.

- In Quelimane District there were a high number of refusals in some villages during the first week of the campaign due to the delay in mobilization by community leaders and because of conflict between the three political parties in the district. Community mobilization was reinforced in these villages with an increased number of radio spots. AIRS Mozambique also disseminated the spray calendar for Quelimane District through radio announcements, a practice that will be repeated in all spray districts in 2015.

## 1.11 NIGERIA

### PROGRAM HIGHLIGHTS

AIRS Nigeria replaced the Jigawa sentinel site with the Sokoto site due to security concerns and under performance by the Principal Investigator. AIRS Nigeria generated local evidence across six sentinel sites to guide intervention strategies in each ecological zone based on the knowledge of local vector composition and behavior.

During this reporting period AIRS Nigeria increased the number of female technicians working on the project and appointed a gender focal person. This change increased acceptability of the project in communities and increased access to homes particularly in the northern part of the country where male technicians are denied access to some households for socio-cultural reasons.

### ENTOMOLOGY

- In October 2014, a total of 2,757 *Anopheles* mosquitoes were collected across all the sentinel sites using a combination of CDC light traps and PSCs. Of this, 2,259 (82%) were *An. gambiae* s.l., 154 (5.6%) were *An. funestus* group, while 319 (11.6%) were *An. coustani* – a potential secondary vector collected in the Nassarawa sentinel site.
- Between November 2014 and February 2015, the study teams using baited CDC light traps and PSC sampling methods, collected a total of 2,639 *Anopheles* mosquitoes. *An. gambiae* s.l. was predominant in all the sentinel sites compared to other *Anopheles* groups over the four-month period, which is in agreement with previous findings in similar locations.
- Due to funding constraints, monthly surveillance activities at the sentinel sites were changed to bimonthly after February 2015.

## 1.12 RWANDA

**TABLE 4: AIRS RWANDA AT A GLANCE**

Number of districts sprayed by PMI-supported IRS	2 districts (Gisagara and Nyagatare)
Insecticide	Carbamates
Number of structures sprayed by PMI-supported IRS	127,150
Number of structures targeted by PMI-supported IRS	127,892
Spray coverage	99.4%
Total population protected by PMI-supported IRS	517,194
Pregnant women protected	8,489
Children under 5 protected	74,279
Dates of PMI-supported IRS campaign	February 9 - March 7, 2015
Length of campaign	24 days
Number of people trained with USG funds to deliver IRS*	1,152

Note: \*This is based on the PMI indicator definition. It includes only spray staff such as spray operators, team leaders, supervisors, and

## PROGRAM HIGHLIGHTS

AIRS Rwanda provided IRS technical and material support to the Ministry of Health's Malaria and Other Parasitic Diseases Division as they conducted IRS in February 2015 in six sectors in Nyagatare District and all sectors in Bugesera District.

### ENTOMOLOGY

- Monthly WHO cone bioassay tests continued into October, November, December 2014, and January 2015 following the September 2014 IRS campaign. Percentage mortalities dropped below 80% four months post-spray in Gisagara, Bugesera, and Nyagatare.
- During the February 2015 IRS campaign cone bioassays were conducted within the first week of spraying for quality assurance. Mortality rates of 100% for susceptible *An. gambiae* s.l. were recorded in all the test sites in the two sprayed districts.
- A control site, Kirehe District (a non-IRS district), was established in January 2015. Further data collection will facilitate comparative analyses and inferences on trends in the intervention districts. Data for the three months since the establishment of a control site show that vector density was generally higher in the control site than the intervention sites.

## I.13 SENEGAL

### PROGRAM HIGHLIGHTS

For the 2015 IRS campaign, NMCP and Senegal's IRS Steering Committee selected a focal spraying strategy in all four districts versus the blanket spraying approach used in previous years. Three of the 2014 IRS districts were maintained (i.e. except Velingara), and the district of Nioro was added. In each district, the malaria incidence by health post is used to select areas for focal spraying (i.e. more than 15 malaria cases per 1,000 residents).

In February, NMCP and the PMI AIRS Project conducted an advocacy visit in IRS districts to explain to stakeholders the focal spraying strategy and other malaria control measures that NMCP plans to implement. The new focal spraying strategy requires necessary updates to the M&E database and mHealth tools. In the same month, the PMI AIRS Project conducted capacity building training in Kaolack for district health agents on all components of IRS operations. Previously trained NMCP and SNH (national training) agents were co-opted as trainers.

Based on the recommendations from the environmental compliance officer's pre-inspection visit of operational sites, district coordinators conducted rehabilitation of operational sites.

AIRS Senegal developed the 2015 Supplemental Environmental Assessment (SEA), which covers pyrethroids, carbamates, organophosphates, and chlorfenapyr for all regions in Senegal for a period of May 20, 2015 – May 19, 2020.

### ENTOMOLOGY

- Results from bioassay tests in 2014 showed that the residual effect of bendiocarb did not exceed two months in Malem Hoddar and Kougheul districts, while the residual life of pirimiphos-methyl CS used in Velingara and Koumpentoum remained high five months after spraying and only started to decrease during the sixth month. AIRS Senegal recommended using pirimiphos-methyl CS for all districts for this year's upcoming campaign on May 22, 2015.

## CHALLENGES AND LESSONS LEARNED

- Revised technical approach from blanket spraying to focal spraying caused stakeholders' delays in decision making about which IRS districts and health zones to target with focal spraying.
- There were advocacy implications in areas that have previously received IRS that will not receive IRS under revised focal spraying technical approach. Implications include upset stakeholders at local health offices and within communities no longer receiving IRS. As other districts continue to receive IRS, the disparity may create perceptions of inequity between districts.
- Training district health workers on the implementation of an IRS project and transferring competencies to government agents will contribute to a local long-term sustainability of IRS.

### 1.14 ZAMBIA

**TABLE 5: AIRS ZAMBIA AT A GLANCE**

Number of PMI-supported provinces	5 (Eastern, Northern, Luapula, Central, Muchinga)*
Number of districts covered by PMI-supported IRS	40
Number of structures sprayed by PMI-supported IRS	409,544
Number of structures targeted by PMI-supported IRS	438,252
2014 spray coverage	93.4%
Population protected by PMI-supported IRS	2,000,824 309,250 children <5 years, 60,978 pregnant women
Dates of IRS campaign	October 13 – December 23, 2014
Length of campaign	65 days
Number of people trained with U.S. Government funds to deliver IRS**	1,460

Note: \*DFID-supported Luapula and Central provinces. \*\*This is based on the PMI indicator definition. It includes only spray staff such as spray operators, team leaders, supervisors, and clinicians. It excludes data clerks, IEC mobilizers, drivers, washers, porters, pump technicians, and security guards.

### PROGRAM HIGHLIGHTS

The AIRS Zambia 2014 IRS campaign, which was originally scheduled to start on September 15th, was delayed until October because the insecticides were delivered late. As recommended by PMI Zambia, the project conducted geographical reconnaissance to plan for targeted spraying in order to align with the national strategy for universal net coverage. AIRS Zambia worked with Akros, a US-based small technology solution firm, to produce detailed maps for 15 districts with the malaria “hot spot” areas based on health facility data layered with the population density information using satellite imagery tools. During the micro-planning meetings with the district authorities, AIRS Zambia discussed the maps to agree on concrete targets and coverage areas for each participating district. Targeting was performed using epidemiological data for the remaining districts.

The Zambia program upgraded the data collection system to use the AIRS project M&E database and spray data collection form to make the data compatible with other country programs under AIRS. The project also introduced the mSpray tool for mobile spray data collection in seven districts in Luapula province, which was developed by Akros. The mSpray platform is a cloud-based data recording and management system that allows spray personnel to electronically collect spray data and GPS coordinates by mobile phone or tablet which can be used to track spray campaign progress. The platform enabled

the field teams to immediately address campaign challenges and improve spray progress. Challenges experienced using this tool will be addressed in time for the next spray campaign.

AIRS Zambia rolled out an IRS training program to all districts and undertook pre-seasonal environmental compliance (EC) inspections. The project rehabilitated infrastructure (soak pits, wash rooms, storage rooms, etc.) in most of the operational sites.

## ENTOMOLOGY

- Entomological surveys were conducted in six districts in Zambia in November 2014 and January and March 2015.
- Treatment and control sites were compared just after the spray campaign, which took place in November and part of December. An overall drop in the average vector densities in the treatment sites was observed compared to most of the control sites, where average density continued to rise steadily.
- During the rainy season, which peaked in February, the March collections showed that densities from both treatment and control sites had risen.
- WHO cone bioassay tests were conducted in November 2014, January and March 2015 to estimate the residual efficacy of sprayed insecticide, Actellic 300 CS. The average percentage mortality (24 hrs) four months after spraying was still over the 80% threshold.

## CHALLENGES AND LESSONS LEARNED

- Planning, coordination, and management of 40 districts coupled with the large distances between districts and the suboptimal support by the government staff was overwhelming for the limited number of AIRS staff in 2014. AIRS Zambia plans to engage district coordinators at the district level to improve coordination and supervision in 2015.
- The project ordered organophosphate class insecticide for the 2014 spray campaign in April-May, but the supplier delayed delivery to Lusaka by approximately seven weeks. This was the main reason for moving the spray start date to October.
- It has been a challenge to recycle the empty Actellic bottles. AIRS Zambia is collaborating with the Zambia Environmental Management Agency to investigate ways of disposing of empty Actellic bottles from the 2014 IRS season.

## 1.15 ZIMBABWE

**TABLE 6: AIRS ZIMBABWE AT A GLANCE**

Number of districts covered by PMI-supported IRS	4 districts (Nyanga, Mutasa, Mutare and Chimanimani)
Insecticide	Pirimiphos-methyl CS (organophosphates)
Number of structures sprayed by PMI-supported IRS	147,949
Number of structures found by PMI-supported IRS	163,922
2014 spray coverage	90.3%
Population protected by PMI-supported IRS	334,746 4,542 pregnant women 54,553 children under 5
Dates of PMI-supported IRS campaign	November 1- December 19, 2014
Length of campaign (operational days)	39
Number of people trained with US government funds to	332

Note: \*This is based on the PMI indicator definition. It includes only spray staff such as spray operators, team leaders, supervisors, and clinicians. It excludes data clerks, IEC mobilizers, drivers, washers, porters, pump technicians, and security guards.

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## PROGRAM HIGHLIGHTS

In 2014, AIRS Zimbabwe shifted from providing technical support to NMCP to leading IRS activities in four districts in Manicaland province. During the reporting period, the country team implemented full IRS operations using organophosphates for the first time in Zimbabwe.

For the campaign, AIRS Zimbabwe refurbished 23 temporary storerooms and soak pits and used smart phones for pre-spray EC assessment. After completion of the spray, AIRS Zimbabwe organized a successful disposal of empty insecticide bottles and cardboard boxes into irrigation pipes and new non-food container boxes. On a national level, AIRS Zimbabwe supported NMCP and the provincial health executives in the development of a national solid waste management plan for the IRS waste generated during the 2014 campaign. In addition, AIRS Zimbabwe and the NMCP implemented the Error Eliminator, an AIRS M&E supervisory tool, in all 47 IRS districts, including the four PMI-supported districts.

## ENTOMOLOGY

- Monthly entomological surveys were conducted at three sentinel sites in Manicaland between October and March; two in IRS sites and one in a control site. AIRS Zimbabwe also monitored vector densities and behavior at seven sentinel sites outside Manicaland.
- In February, three months post-spray, AIRS Zimbabwe included susceptible colony mosquitoes from National Institute of Health Research to monitor the residual bio-efficacy of insecticide on sprayed surfaces using WHO cone bioassay tests. The average mortality (24 hrs) with the susceptible colony of *An. arabiensis* was 81.3%, and 67.9% with the wild *An. gambiae* s.l. mosquitoes in Burma Valley three months post-spraying (T3). In Chakohwa sentinel site, 91% and 93% mortality were observed for the susceptible colony of *An. arabiensis* and wild *An. gambiae* s.l., respectively three months post-spraying (T3).
- The project conducted a new round of susceptibility tests between December 2014 and February 2015 at six sentinel sites: Manjolo, Makakavhule, Kamhororo, Old Mazowe Bridge, Chilonga, and Chakari. *An. gambiae* s.l. was resistant to lambda-cyhalothrin in Manjolo and Chakari. Resistance to bendiocarb was recorded in Makakavhule and Chakari. Suspected resistance to DDT was observed in Makakavhule, Kamhororo, and Chilonga. Similarly, suspected resistance to bendiocarb was observed in Kamhororo. The vector population from all six sites were susceptible to pirimiphos-methyl.

## CHALLENGES AND LESSONS LEARNED

- Although the introduction of the Goizper pump was initially well-received, spray operators faced challenges using it due to frequent blockages and breakdowns. Teams had to resort to using the Hudson pumps in a number of cases. Training on the use and maintenance of the Goizper pumps needs to be intensified for both supervisors and spray operators.
- To avoid delays in clearing imported IRS equipment and commodities, AIRS Zimbabwe would likely benefit from developing an MOU with the Ministry of Health and Child Care.
- NMCP allows seasonal workers to take the PPEs home at the end of each campaign as an additional form of incentive. AIRS Zimbabwe's retrieval of such items appeared to be against the country IRS policy and was not well-received by supervisors and SOPs; hence PPE retrieval rate was below 100%. Effective PPE retrieval mechanisms are therefore required to improve retrieval

rate at the end of each IRS campaign.

- The allocated budget for the 2014 IRS campaign in the four districts was a major challenge given that almost 50 percent of the total allocated funds was devoted to procurement of the insecticide.

## 2. CORE SECTION

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### 2.1 EPIDEMIOLOGICAL SURVEILLANCE

During the reporting period of October 2014 through March 2015, the PMI AIRS Project continued the epidemiological surveillance work in Mozambique and Angola that began under TO4 and formulated epidemiological surveillance strategies under TO6. Note that Angola completed epidemiological surveillance under TO4 and it will not be continued under TO6.

In January 2015, the PMI AIRS team met with PMI/Washington to discuss past and potential AIRS epidemiological surveillance work. A related overview document was submitted at that time and the document has evolved and been edited as the country-specific epidemiological scopes of work have changed. In February 2015, the PMI AIRS Project presented and received feedback on a project-wide strategy regarding the methodology of selecting the health facilities from which data will be collected for use in epidemiological analysis. Additionally, during the reporting period PMI AIRS Project countries – whether funded through the project or PMI operational research funds – have developed and refined their individual epidemiological surveillance strategies.

### 2.2 MHEALTH

During the reporting period, the PMI AIRS Project identified mobile technology-based tools that will be rolled out to all spraying countries over the course of the first two years of the TO6 contract. Two tools that will move from pilots to the project-wide implementation are the Performance Management Tracker (PMT) and the SMS-based Job Aid for Spray Operations. The third technological upgrade is moving smart phone-based supervisory forms to a new cloud-based platform and creating a user-friendly template for summary reports to continue standardization of use of the forms.

Dimagi, a small technology firm based in Cambridge, Massachusetts, and a partner on the PMI AIRS Project, has completed most of the design and development of the tools during the reporting period. Dimagi also transferred the supervisory forms to CommCare, a platform that they use for cloud-based data management and storage.

### 2.3 CAPACITY BUILDING

Countries began implementing activities related to the action points from the Country Capacity Assessments conducted in 2013. These activities were written into the annual country work plans. The PMI AIRS Project began working with EnCompass to develop a curriculum for IRS. During this period, the technical leads on the project met with EnCompass and provided them with the material to be included in the curriculum. A framework and timeline for implementing capacity building workshops (“boot camps”) for district and national level officials in three pilot countries was agreed upon.

An important environmental compliance capacity-building activity was initiated in January 2015, when the Ethiopian Environmental Compliance Officer was asked to develop a first draft of the SEA revision that was required to support nationwide training and other activities. This was the first instance within PMI of an in-country ECO preparing an SEA draft, and it was done without STTA from AIRS headquarters staff or an outside consultant. This project was possible because of the advanced professional standing of that ECO, and his advanced English writing skills.

## 2.4 COST EFFICIENCY

The PMI AIRS home office team brainstormed ideas for cost reduction at the planning retreat in Charlottesville, VA. Ideas discussed included decreasing the number of mobilizers, staggering spray starts each day to reduce vehicle rental, and reducing training days and spray campaign days, among other ideas. A Tech Talk was convened for all COPs to discuss the results and encouraged them to think about how they can restructure their spray program to reduce costs without jeopardizing quality. Work plan narratives submitted now include a section on cost savings that highlights activities each team proposes undertaking to reduce costs this year.

## 2.5 NEW EMPLOYEES

Keith Mangam, M&E Specialist, provides support to the AIRS M&E teams in Angola, Mali, Senegal and Zimbabwe. He supports the Epidemiological Technical Working Group and the mHealth Technical Working Group, and facilitates mHealth activities that are being carried out by Dimagi Inc.

Technical program manager Brad Longman supports country programs in Angola, Benin, Liberia, and Senegal. He co-leads the project's Capacity Building Working Group and supports the Gender and Cost Efficiency Working Groups.

## 2.6 CONFERENCES

### **Pan African Mosquito Control Association Conference**

The PMI AIRS Project participated in the first Pan African Mosquito Control Association Conference in Nairobi, Kenya, from October 6-8th, 2014. Over 150 researchers, vector control program managers, students, industry representatives, NGOs, and representatives from academic institutions from across Africa, Europe, and North America attended the conference to share ideas, collaborate and explore innovative approaches to combat vector borne diseases. The PMI AIRS Project submitted four abstracts. One abstract was accepted for oral and three for poster presentations. AIRS project staff from Bethesda (Dereje Dengela), Ethiopia (Yemane Yihdego), Liberia (Godwil Munyekenye), Mali (Moussa Cisse) and Ghana (Aklilu Seyoum) attended the conference and presented findings from the PMI AIRS Project's entomological monitoring.

### **Roll Back Malaria Vector Control Working Group**

The PMI AIRS Project Director Bradford Lucas, Senior Technical Director Dereje Dengela, and Director of Operations Allan Were attended the Roll Back Malaria Vector Control Working Group's annual meeting January 28 -30, 2015, in Geneva, Switzerland. Dereje Dengela was appointed the new co-chair of the Working Group's IRS Work Stream. Brad Lucas presented on building country capacity in IRS and Allan Were presented on ways the project has improved efficiency in IRS, resulting in cost savings.

### **American Public Health Association Conference**

AIRS M&E Specialist Beth Brennan presented *Mobile Data Collection to Improve Data Quality and Speed of Results: Lessons from Angola* at the American Public Health Association's (APHA) Annual Conference to approximately 85 attendees in New Orleans, LA, November 15-19, 2014.

### **USAID Global Health Mini-University**

On March 3, 2015, AIRS M&E Specialists Beth Brennan and Elana Fiekowsky presented *Mobile Technology for Improved Malaria Community Mobilization and Project Supervision* at USAID's Global Health Mini-University in Washington, DC, at George Washington University.

### **American Society of Tropical Medicine and Hygiene Conference**

The PMI AIRS Project presented posters on seven different topics at the 63rd Annual American Society of Tropical Medicine and Hygiene Conference in New Orleans, November 2-6, 2014, including:

1. Assessing the Association between IRS and Recorded Malaria Cases in Benin's Health Management Information System;
2. Longitudinal Impact of IRS on Malaria Parasitaemia in Northern Ghana;
3. Mobile Soak Pits: A New Mousetrap for Improved IRS Environmental Compliance and Operational Efficiency;
4. Multi-country Profile of Insecticide Resistance on Malaria Vectors in the PMI AIRS Project Countries;
5. Opportunities for Gender Equitable Employment in PMI-supported IRS Campaigns;
6. Population Dynamics of Major Malaria Vectors and the Impact of IRS on EIR in Nasarawa State, North Central Nigeria; and
7. Impact of IRS on Entomological Indices of Malaria Transmission in the Bunkpurugu-Yunyoo District in the Northern Savannah Zone of Ghana.

### **AIRS Retreat**

Headquarters' project staff and the PMI COR Team gathered in Charlottesville, VA, for a three-day planning retreat, October 29-31. The retreat included brainstorming workshops on ways to make the project more cost-effective, environmentally-compliant, and gender equitable as well as how to expand community-based IRS and improve capacity of National Malaria Control Programs. Six working groups were established: mHealth, capacity building, gender, cost-efficiency, operational research, and epidemiology.

## **2.7 COMMUNICATIONS**

The PMI AIRS Project website ([www.africaairs.net](http://www.africaairs.net)) received 49,007 website visits from October 1, 2014, to March 31, 2015, maintaining approximately the same rate of site visits as the previous six months.

During this period, five success stories were written, posted on the project and PMI websites, shared on Abt Associates' Facebook page and the AIRS Twitter feed, and distributed via the AIRS quarterly e-letter. AIRS distributed two e-letters (in December and March) and one e-alert in March to more than 3,700 global health professionals. One infographic was developed for use on social media and was sent via an e-alert.

Two photo stories (Senegal and Madagascar) were shared on the project and Abt websites. The first profile in the PMI AIRS Project Malaria Fighter series was developed and shared widely through social media, and the PMI, AIRS, and Abt websites.

One video on the benefits of IRS in Madagascar was produced during this time but had not yet been approved by the end of the reporting period.

Monthly Tech Talks continued with the COPs to encourage peer-to-peer exchange across the project. Topics included: new focus areas/activities for TO6, working groups, cost-efficiency, supervision checklists, Environmental Mitigation and Monitoring Plan (EMMP) and the Environmental Mitigation and Monitoring Report form (EMMR), and removing gender barriers.

## **2.8 JOURNAL PUBLICATIONS**

Five manuscripts were submitted to PMI during this reporting period, two of which have been cleared and submitted to journals. Comments and inputs have been received from the COR and other PMI teams on the other three manuscripts. Manuscripts include:

1. “The effect of different wall surfaces and spray water pH on the decay rate of carbamates” – submitted to *Parasites and Vectors* March 5<sup>th</sup>
2. “Characterizing *Anopheles gambiae* s.l. insecticide resistance in Mali” – submitted to *Malaria Journal* March 11<sup>th</sup>
3. “Assessing epidemiological trends to monitor indoor residual spraying in Benin: Are regularly available data good enough?”
4. “Multi-Country Assessment of Residual Bio-efficacy of Insecticides Used for Indoor Residual Spraying in Malaria Control on Different Surface Types: Results from Program Monitoring in 15 PMI/USAID supported IRS Countries”
5. “Opportunities for Gender Equitable employment in PMI-Supported Indoor Residual Spraying Campaigns”

## 2.9 BEST MANAGEMENT PRACTICES

The second edition of the *PMI Best Management Practices (BMP) for Indoor Residual Spraying in Vector Control Interventions*, which establishes best practices for IRS activities to ensure compliance with USAID and host country environmental regulations, was released in March. Revised and updated during this reporting period, the new BMP expands upon the 2010 edition and serves as the official guide for all PMI IRS projects. The manual, which was coordinated by the project’s Environmental Compliance and Safety Manager Peter Chandonait, includes best practices on the range of activities associated with pesticide use in IRS. The new BMP also includes guidance around the PMI AIRS innovative Mobile Soak Pit, which has been approved by USAID’s Bureau of Global Health Environmental Officer.

### 2.10 MOBILE SOAK PIT TESTING

Environmental Compliance and Safety Manager Peter Chandonait and Abt Senior Associate David Mitchell tested the chemical performance of the Mobile Soak Pits (MSPs) at the Cambridge, Massachusetts, office of Abt Associates Inc., in both outdoor and indoor laboratory settings over the period October-December 2014. They assessed the performance of the MSP in removing Actellic CS and EC, branded formulations of pirimiphos-methyl produced and marketed by Syngenta Crop Protection AG, from prepared challenge solutions. The test was designed to simulate the conditions of an actual spray campaign, and was conducted over the equivalent of 40 spray days. The laboratory tests confirmed the ability of the filters to substantially reduce effluent concentrations of pesticide, with removal rates ranging from a high of 99.9 percent to a low of 67 percent. It was shown that the MSP was capable of reducing effluent concentration of pesticide in wash-waters to below one part per million, and maintaining its performance over the simulated spray season.

### 2.11 GENDER

The Gender Technical Working group began under the new Task Order, and established participants and a scope of work for the group. To determine the Working Group’s objectives for the first year, and over the course of the three-year project, the PMI AIRS Project team worked closely with the PMI COR team to identify and clarify project objectives, such as creating Sexual Harassment Guidelines, which are posted at every operational site.

The PMI AIRS Project worked with COPs and country offices to select a gender focal point for each country. These focal points are responsible for ensuring their country programs are gender inclusive and for implementing the working group objectives, in addition to completing their other work on the project. Because this is a new work stream for our gender focal points, the technical working group built a curriculum, culminating with a three-day training, to build up our focal points’ capacity to lead this work in their country office.

Leading up to the training, the technical working group held bi-weekly calls with the focal points. Every call had a theme, such as Gender 101 or sexual harassment at the work place. Before each call, the focal points were given homework to do to prepare for the call. The call would then be a facilitated discussion on that topic; the focal points were expected to participate and contribute to the discussion. These phone calls and homework assignments built a common understanding and set the expectations for the gender training.

The Gender Training for all of the gender focal points was held from March 23-25, 2015 in Kigali, Rwanda, and included participants from USAID/Rwanda and the Rwandan government. The PMI AIRS Project Gender Technical Working Group Lead Elana Fiekowsky, led the training with Abt's Gender Advisor Abigail Donner, the COR Team Lead Allison Belemvire, and the USAID Senior Gender Advisor Niyati Shah. The training included presentations on gender definitions and concepts, the need for gender inclusion on the PMI AIRS Project, and the PMI AIRS Project objectives for ensuring gender inclusion. The gender focal points also created a Strength, Weaknesses, Opportunities and Threats (SWOT) Analysis for their country's gender context, a gender operational plan, and prepared a presentation to give to their home office. Entomology

### **Chlorfenapyr study**

The PMI AIRS Project in collaboration with BASF Pest Control Solutions, Public Health, and Nigeria Institute for Medical Research (NIMR) studied the efficacy and residual activity of chlorfenapyr: a pyrrole class of insecticide in comparison with the carbamate insecticide bendiocarb and the pyrethroid insecticide alpha-cypermethrin in experimental huts under field conditions in Nigeria. The study was conducted in two phases from August 2014 to February 2015. The first phase of the study was to assess the susceptibility level of wild *An. gambiae* s.l. from the experimental site to the three study insecticides using CDC bottle bioassays. In the second phase of the study experimental huts were sprayed with the study insecticides at dosages recommended by WHOPES, and their impact on entomological indicators and residual activity was evaluated. Efficacy was assessed in terms of reduction in hut entry, blood feeding inhibition, and mosquito mortality. The residual efficacy of the three insecticides was assessed using Kisumu and field-collected *An. gambiae* s.l. over pre-selected various times of exposure (0.5hr, 1hr, 2 hrs, and 3hrs) and holding periods (24hrs and 48hrs).

Data from susceptibility tests showed that *An. gambiae* s.l. from the experimental hut site was fully susceptible to chlorfenapyr (98-100% mortality) and bendiocarb (100% mortality) but resistant to alpha-cypermethrin (88% mortality).

Data from the experimental hut trial did not show significant reduction in the number of mosquitoes entering huts sprayed with chlorfenapyr relative to either alpha-cypermethrin or bendiocarb. But chlorfenapyr killed a significantly higher proportion (61%) of wild (FAP) resistant strain of *Anopheles* compared with alpha-cypermethrin (39.2%) and bendiocarb (51.6%). The application of chlorfenapyr also resulted in significant reduction in blood feeding (<10%) compared with alpha-cypermethrin (24%) and bendiocarb (30%). Overall, bioassay results showed that chlorfenapyr has a slow effect but much longer residual efficacy compared to bendiocarb and alpha-cypermethrin. Using the 80% mortality threshold in one-hour exposure and 48-hour post-exposure period, chlorfenapyr has a residual effect of about four months with a potential to control pyrethroid resistant *Anopheles* mosquitoes over this period. Bendiocarb and alpha-cypermethrin lasted less than two months and four months respectively. The PMI AIRS Project is currently working to submit a standalone updated final report of the study that addresses comments from the COR team.

The cone bioassay test results are encouraging; however, the laboratory results of filter papers attached to the spray surface to assess the amount of insecticide applied to the walls indicated overdosing of all three types of insecticide used for the study. The PMI AIRS Project and BASF began investigating the results by testing control filter papers and documenting the details of calibration, mixing and spraying procedures.

## **Disease Data Management System (DDMS)**

The Disease Data Management System (DDMS) supports malaria data entry and storage and is able to generate reports and visual maps. The PMI AIRS Project plans to expand use of the entomology module of DDMS to three AIRS countries (Ghana, Mali, and Rwanda) in 2015. A one-day training on the DDMS was held on January 12, 2015, for AIRS home office and the COR team at Abt's office in Bethesda. Seven people, five people from the PMI AIRS Project and two from PMI, participated in this training. In addition, Jean Goodman, who currently serves as the technical point person for DDMS at Abt, attended three days of extensive training on:

- Defining/creating data entry screen or editing the existing entry screens;
- Creating datasets with different data types;
- Detail steps on the query design and editing; and
- Basic information about the backend database structure.

The Ghana DDMS server was successfully set up, and PMI AIRS in-country project staff, major malaria partners, and members under the Malaria Vector Control Oversight Committee of the NMCP completed training as planned February 9-12, 2015. In total, 15 participants were trained. DDMS is now fully functional in Ghana.

## **2.12 TRANSITION**

Beginning October 15<sup>th</sup>, the Abt team began transitioning country programs from TO4 to TO6. As part of this process, the AIRS Team examined the organogram of each country team to ensure that staffing patterns were appropriate for the scope of each country program under TO6. Contractually, because of the need to pay and bill severance accrued under TO4 to TO6, Abt needed to fire over 200 employees and, in most cases, recruit, interview, and either re-hire or onboard the final teams. This was done on a rolling basis. The transition schedule can be found in Annex C.

In order to accomplish this transition, we drew on the AIRS Home Office cross-functional country teams (finance and contracts, technical, and project leadership), field leadership, and support departments within Abt (Human Resources, International Accounting, Recruitment, IT, and division management) to envision optimal country teams, develop transition timelines, and prioritize tasks. We also utilized the expertise of local labor lawyers to advise on the best way to transition teams without exposing the project to legal action.

In addition, in an effort to provide new insights and fresh perspectives (e.g. Ethiopia and Rwanda), respond to changing scopes (e.g. Angola, Liberia, and Nigeria) and to provide opportunities for Chiefs of Party (COPs) to return home (Mozambique and Zambia/Ghana), we also undertook a reorganization of country responsibilities for our COPs. Seven COPs were either reposted or repatriated during the transition time period (Ranjith deAlwis, Josephat Shililu, Yemane Yihdego, Lourdes Loch\*, Ibrahima Baber, Cathy Clarence\*, Xavier Pitroipa\* and Peter Mumba) with one internal promotion to COP (Rodaly Muthoni).

The transition represented a great deal of LOE, and Abt is pleased that country programs continued to operate seamlessly throughout due to the strength of our country teams.

\*Those with an asterisk transitioned after the period of this report but activities were undertaken during the period of this report toward making their transition happen.

## **2.13 TANZANIA START-UP**

In December, PMI informed the project that the Tanzania IRS program would transfer to the PMI AIRS Project beginning with the 2016 campaign. In February, Project Director Brad Lucas and Operations

Director Allan Were traveled to Tanzania to meet with the PMI mission, RTI, the current IRS implementer, the Ministry of Health, and NMCP officials from both the mainland program in the lake zone and in Zanzibar. The PMI AIRS Project was able to see the IRS program in progress in several lake-zone districts and in Zanzibar, which will inform decisions about any changes to IRS project strategies and structures going forward.



# ANNEX A: INSECTICIDE AND EQUIPMENT PROCUREMENT

Commodity	Country	Description	Total Cost	Order/PO Date	Delivery Date
Entomology Supplies	Angola	Entomology Monitoring Supplies	\$8,122.00	Dec, 2014	March, 2015
Entomology Supplies	Angola	Impregnated Papers	\$770.00	Nov, 2014	Dec, 2014
Security Supplies	Benin	Door locks	\$218.00	Mar, 2015	May, 2015
Personal Protective Equipment	Benin	PPE	\$14,361.40	Mar, 2015	Apr, 2015
Hudson Sprayers & Parts	Benin	Nozzles, Spare Parts	\$3,371.00	Mar, 2015	May, 2015
Goizper Sprayers & Parts	Benin	Valves, Spare Parts	\$2,674.90	Mar, 2015	Mar, 2015
Micron Spare Parts	Benin	Spare Parts	\$4, 463.63	Mar, 2015	Apr, 2015
Entomology Supplies	DRC	Entomology Monitoring Supplies	\$968.00	Mar, 2015	*Pending
Entomology Supplies	DRC	Entomology Monitoring Supplies	\$4,523.76	Mar, 2015	*Pending
Entomology Supplies	DRC	Entomology Monitoring Supplies	\$722.64	Mar, 2015	*Pending
Entomology Supplies	DRC	Entomology Monitoring Supplies	\$937.00	Mar, 2015	*Pending
Entomology Supplies	DRC	Impregnated Papers	\$830.00	Mar, 2015	April, 2015
Entomology Supplies	Ethiopia	Entomology Monitoring Supplies	\$5,590.00	Dec, 2014	April, 2015
Entomology Supplies	Ethiopia	Impregnated Papers	\$5,300.00	Jan, 2015	Feb, 2015
Entomology Supplies	Ethiopia	Impregnated Papers	\$8,100	Mar, 2015	May, 2015
Personal Protective Equipment	Ethiopia	PPE	\$126,694.80	Mar, 2015	Apr, 2015
Insecticides	Ethiopia	Organophosphates	\$2,080,327.32	Mar, 2015	*Pending
Micron Spare Parts	Ethiopia	Spare Parts	\$17,793.33	Mar, 2015	Apr, 2015
Insecticides	Ghana	Organophosphates	<b>\$1,277,513</b>	Dec, 2014	Mar, 2015
Entomology Supplies	Ghana	Entomology Monitoring Supplies	<b>\$2,544</b>	Dec, 2014	Apr, 2015
Personal Protective Equipment	Ghana	PPE	\$44,267.80	Fev, 2015	Apr, 2015
Hudson Sprayers & Parts	Ghana	Spare Parts	<b>\$22,553.88</b>	Mar, 2015	Apr, 2015

Commodity	Country	Description	Total Cost	Order/PO Date	Delivery Date
Goizper Sprayers & Parts	Ghana	Spare Parts	\$5,580.50	Mar, 2015	Mar, 2015
Entomology Supplies	Ghana	Bio Monitoring Supplies	<b>\$19,840</b>	Feb, 2015	Apr, 2015
Entomology Supplies	Ghana	Light traps, batteries, charger	<b>\$577.11</b>	Feb, 2015	Feb, 2015
Entomology Supplies	Liberia	Impregnated Papers	<b>\$2,010</b>	Apr, 2015	*Pending
Entomology Supplies	Liberia	Entomology Monitoring Supplies	<b>\$3,394.00</b>	Apr, 2015	*Pending
Personal Protective Equipment	Mali	PPE	\$62,961.10	Jan, 2015	*Pending
Hudson Sprayers & Parts	Mali	Spare Parts	\$18,259.90	Mar, 2015	*Pending
Micron Spare Parts	Mali	Spare Parts	\$2,990.70	Mar, 2015	Apr, 2015
Insectisides	Mali	Organophosphates	<b>\$1,328,921.28</b>	Dec, 2014	*Pending
Entomology Supplies	Nigeria	Entomology Monitoring Supplies	<b>\$1,461</b>	Jan, 2015	Apr, 2015
Entomology Supplies	Nigeria	Batteries, Charger	<b>\$368.44</b>	Jan, 2015	Apr, 2015
Entomology Supplies	Nigeria	Impregnated Papers	<b>\$5,402</b>	Jan, 2015	Feb, 2015
Personal Protective Equipment	Rwanda	PPE	<b>\$29,826.15</b>	Nov, 2014	Jan, 2015
Hudson Sprayers & Parts	Rwanda	Spare Parts	\$15,683.44	Nov, 2014	Jan, 2015
Insectisides	Rwanda	Carbamates	<b>\$1,162,356.48</b>	Dec, 2014	Jan, 2015
Entomology Supplies	Rwanda	Impregnated Papers	<b>\$3,690.00</b>	Mar, 2015	Apr, 2015
Personal Protective Equipment	Senegal	PPE	<b>\$24,626.40</b>	Dec, 2014	Mar, 2015
Micron Spare Parts	Senegal	Spare Parts	\$4,463.63	Mar, 2015	Mar, 2015
Insectisides	Senegal	Organophosphates	<b>\$1,173,457.81</b>	Dec, 2014	May, 2015
Insectisides	Zambia	Organophosphates	<b>\$624,190.20</b>	Mar, 2015	*Pending
Entomology Monitoring Supplies	Zambia	Entomology Monitoring Supplies	\$5,542.00	Dec, 2014	Jan, 2015
Entomology Monitoring Supplies	Zambia	Entomology Monitoring Supplies	\$2,055.60	Nov, 2014	Jan, 2015
Entomology Supplies	Zambia	Impregnated Papers	\$1,699.00	Dec, 2014	Jan, 2015
Entomology Supplies	Zambia	Entomology Monitoring Supplies	\$1,793.38	Oct, 2014	Jan, 2014

# ANNEX B: M&E RESULTS SUMMARY

## IRS RESULTS OCTOBER 2014–MARCH 2015

Country	# Structures Sprayed	Spray Coverage	Total Population Protected	Children Under Five Protected	Pregnant Women Protected	# People Trained*
Angola	14,649	88.7%	58,370	12,531	1,413	187
Madagascar	274,533	95.7%	1,307,384	175,214	30,731	809
Mozambique	445,118	93.1%	2,327,815	404,707	159,830	1,354
Rwanda	127,150	99.4%	517,194	74,279	8,489	1,152
Zambia***	409,544	93.4%	2,000,824	309,250	60,978	1,460
Zimbabwe*	147,949	90.3%	334,746	54,553	4,542	332
<b>AIRS TOTAL</b>	<b>1,418,943</b>	<b>93.9%</b>	<b>6,546,333</b>	<b>1,030,534</b>	<b>265,623</b>	<b>5,294</b>

\*Includes spray staff (e.g., spray operators, team leaders, supervisors, clinicians) only. Excludes data clerks, IEC mobilizers, drivers, washers, porters, pump technicians, and security guards

# ANNEX C: TRANSITION SCHEDULE FROM TO4 TO TO6

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	<b>Transition Date</b>
CORE	1-Jan-15
Angola	1-April-15
Benin	15-Oct-14
Burundi	30-Oct-14
DRC	30-Oct-14
Ethiopia	1-Jan-15
Ghana	30-Nov-14
Liberia	30-Oct-14
Madagascar	1-Apr-15
Mali	1-Jan-15
Mozambique	1-Apr-15
Nigeria	15-Nov-14
Rwanda	1-Dec-14
Senegal	30-Oct-14
Zambia	1-Mar-15
Zimbabwe	1-Mar-15