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 Africa Indoor Residual Spraying Program

AIRS

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ACRONYMS

AIRS	Africa Indoor Residual Spraying Project
BMP	Best Management Practices for Indoor Residual Spraying in Vector Control Interventions
COP	Chief of Party
CREC	Entomological Research Center of Cotonou
DHMT	District Health Management Team
DPS	Provincial Health Directorate
F&A	Finance and Administration
IEC	Information, Education, Communication
IRS	Indoor Residual Spraying
M&E	Monitoring and Evaluation
MOU	Memorandum of Understanding
N/A	Not Available
NMCP	National Malaria Control Program
PMI	President's Malaria Initiative
PMP	Performance Management Plan
PPE	Personal Protective Equipment
RFQ	Request for Quotation
RTT	RTT Group, Ltd
SEA	Supplemental Environmental Assessment
UCAD	Université Cheikh Anta Diop de Dakar
USAID	U.S. Agency for International Development
USG	United States Government
WHO	World Health Organization
ZISSP	Zambia Integrated Systems Strengthening Program

EXECUTIVE SUMMARY

Over the past six months (April–September 2012), the Africa Indoor Residual Spraying (AIRS) team has worked tirelessly to prepare countries for high-quality indoor residual spraying (IRS) campaigns. During this performance period, eight AIRS countries (Benin, Burkina Faso, Ethiopia, Ghana, Liberia, Mali, Nigeria, and Senegal) completed their campaigns. All exceeded the target of spraying 85 percent of eligible structures. From April through September 2012, AIRS sprayed approximately 1.8 million structures and protected more than 5 million people in Africa from malaria.

Although IRS is a well-established malaria prevention program, AIRS staff found creative ways to build local capacity to carry out IRS and make IRS more efficient. For the first time in Ethiopia, AIRS employed existing health extension workers to carry out information, education, and communication (IEC) and community mobilization activities at the community level and conducted a community-based pilot in one district. When the political situation in Mali prevented AIRS from working with their entomological monitoring partner, the AIRS team responded by creating an innovative, low-cost insectary at the AIRS Mali office.

AIRS is committed to using data to guide effective IRS. AIRS has invested in improving entomological monitoring activities to evaluate spray campaigns and inform future decision-making. This includes conducting baseline entomological monitoring, using spray and control districts, using wall bioassays to measure spray performance and residual efficacy, and establishing sentinel sites for insecticide resistance monitoring. In the area of operations, supervisors are using data from the performance tracker tool to monitor spray team performance. AIRS has also invested in improving spray data collection through the development of a single, core Microsoft Access database that has been deployed in eight countries as of this performance period.

During this period, AIRS supported several regional trainings in the areas of monitoring and evaluation, finance and administration, environmental compliance, and leadership and management. AIRS is promoting knowledge sharing through South-South technical assistance provided by experienced field staff to mentor other country programs. For example, the AIRS Benin operations manager traveled to Mozambique to help their operations manager prepare for the IRS campaign. Also, the Ghana environmental compliance officer provided technical assistance to the AIRS Angola team.

While the first six months of the AIRS project were focused on start-up activities, in April–September 2012, AIRS implemented high-quality IRS campaigns in eight countries. Country and home office staff are incorporating what they learned from these first spray rounds to continue to improve the efficiency, effectiveness, and quality of IRS in future spray campaigns.

I. COUNTRY PROGRAM HIGHLIGHTS

I.1 ANGOLA

TABLE I: AIRS ANGOLA AT A GLANCE

Number of provinces/districts covered by PMI-supported IRS in 2012	3 provinces (Cunene, Huambo, and Huila)
Insecticide	Pyrethroid
Estimated number of structures targeted for spray as reported in 2012 Work Plan	136,000
2012 spray coverage	N/A ¹
Estimated population to be protected by PMI-supported IRS in 2012	650,000
Anticipated dates of PMI-supported IRS campaign	October 29, 2012–December 2012
Number of people to be trained with USG funds to deliver IRS ²	N/A ¹

¹This information will be available after the spray campaign is completed.

²This is based on the PMI indicator definition. It includes spray personnel such as spray operators, team leaders, supervisors, and clinicians. It excludes data clerks, IEC mobilizers, drivers, washers, porters (who did not attend standard operating procedures training), pump technicians, and security guards.

Entomology

In May 2012, with the technical lead of Dr. Joseph Mwangangi, senior entomologist consultant, AIRS Angola conducted an insecticide susceptibility study to inform insecticide selection for the 2012 campaign. Dr. Mwangangi provided additional training to Luis Goncalves, AIRS Angola entomology coordinator. Together, they worked in the three IRS target provinces in collaboration with the provincial health departments on larvae collection. Larvae were transported, reared to adult mosquitos, and tested in the insectary that AIRS Angola set up in the Huambo office. Vector susceptibility was tested against pyrethroids, organophosphates, and carbamates using World Health Organization (WHO) bioassay kits. *An. gambiae s.l* mortality rates after one hour exposure and a 24 hours holding period ranged from 93.5 percent to 97.5 percent for pyrethroids. The study findings and recommendations were shared with the National Malaria Control Program (NMCP), the respective provincial health directorates (DPSs) and PMI. Based on these findings, stakeholders agreed to use pyrethroids for the 2012 campaign.

Program Highlights

During the period covered by this report, AIRS Angola focused on planning and preparing for the October IRS campaign. In the absence of environmental compliance experts in Angola, AIRS Angola hired a seasoned professional, Mr. Deolindo Dungula. Mr. Williams Abilla, AIRS Ghana environmental compliance officer, traveled to Angola to provide on-the-job training to Mr. Dungula on PMI's *Best Management Practices for Indoor Residual Spraying in Vector Control Interventions* (BMP) for environmental compliance. In partnership with the DPS and the Ministry of the Environment in the three target provinces, Mr. Abilla and Mr. Dungula conducted an assessment of the warehouses and operational sites, which have since been rehabilitated in accordance with BMP prior to the spray launch. Micro-planning was conducted at the provincial level, together with the DPSs, as well as municipal and traditional authorities to build consensus on recruitment, training, and other operational logistics for the 2012 spray campaign. One change that resulted from this meeting was the move to a six-day work week for seasonal workers. AIRS anticipates that the extended

work week, which was approved by the government, will lead to a shorter IRS campaign that will save money on vehicle rentals (since they will be rented for shorter periods of time) and fuel.

AIRS recruited, trained, and tested 11 data entry clerks in the three target provinces in August. Project staff successfully set up data centers in each of the provinces.

Challenges and Lessons Learned

Efforts to strengthen partnerships with the DPSs (in a decentralized environment) are ongoing. However, the gap in PMI representation in country and the lack of involvement by the NMCP presented challenges. In July 2012, Abt Associates and the NMCP signed a memorandum of understanding (MOU) establishing the roles and responsibilities of Abt Associates and the Government of Angola. However, assignment of these roles has to trickle down to the provincial level in order to have the desired effect.

National elections caused significant delays and limited the availability of government partners to support AIRS in the planning stages leading up to training and spray launch. Notably, there were delays from the Ministry of Foreign Affairs in releasing duty free letters for the import of insecticide and other IRS commodities. This delayed mobilization activities and the spray campaign.

1.2 BENIN

TABLE 2: AIRS BENIN AT A GLANCE

Number of provinces/districts covered by PMI-supported IRS in 2012	9 districts in Atacora region (Boukoumbe, Cobli, Kerou, Kouande, Materi, Natitingou, Pehunco, Tangueita, and Toucountouna)
Insecticide	Carbamate
Number of structures covered by PMI-supported IRS in 2012	210,380
Number of structures targeted by PMI-supported IRS in 2012 ³	221,937
2012 spray coverage	95%
Population protected by PMI-supported IRS in 2012	652,777 (including 17,807 pregnant women and 127,133 children under 5)
Dates of PMI-supported IRS campaign	May 13, 2012–June 25, 2012
Length of IRS campaign	35 days
Number of people trained with USG funds to deliver IRS	825

³Based on the actual count of eligible structures found by spray operators in the geographic area that was targeted for spraying as opposed to estimates from the work plan.

Entomology

Under an extended subcontract from AIRS Benin, the Entomological Research Center of Cotonou (CREC) continued to complete entomological monitoring on behalf of PMI/Benin and AIRS Benin for the 2012 IRS campaign. CREC completed a baseline data collection one month before the IRS campaign, noting that *An. gambiae* s.l. continued to be the most prevalent mosquito species in the Atacora Region where AIRS was spraying insecticide. During the first week of the IRS campaign, CREC completed wall bioassays tests at two sentinel sites in Atacora, and found that AIRS Benin was completing a high quality of spraying, as test mortality rates for mosquitoes in both sentinel sites was 100 percent after 30 minutes exposure to the sprayed walls and a 24 hour holding period. One month after the start of the IRS campaign, the carbamate insecticide remained effective with a test mortality rate of 100 percent on both cement walls and mud walls. Two months after spraying bendiocarb, wall bioassays tests showed that test mortality rates of vector mosquitoes ranged from 81.92 percent on the mud walls to 96.55 percent on the cement walls, exceeding the 80 percent mortality threshold set by PMI. However, bioassays completed by CREC three months after spraying noted the efficacy of carbamates on both mud and cement walls declined below the 80 percent mortality threshold in all houses tested, ranging from 56.71 percent vector mortality on mud walls to 75.5 percent vector mortality on cement walls. Though the effective life of bendiocarb falls within WHO's recommended 2-6 months range, Abt, PMI, and the insecticide manufacturer are working to understand the cause and find ways to improve the residual life of bendiocarb. Due to the finding that carbamates had a short residual life, change in the use of insecticide for 2013 IRS operation was recommended.

CREC also performed insecticide resistance tests aimed to inform selection of insecticide for the 2013 IRS program. The tests were conducted two to three months after the 2012 spraying. The test mortality rates were 42- 57 percent for deltamethrin, 84 percent for fenitrothion, 58.6-78.6 percent for bendiocarb and 100 percent for primiphos-methyl. This data indicates that *An. gambiae* s.l., the main malaria vector in the country, has developed resistance to pyrethroids and carbamates—two of the four classes of insecticides recommended by WHOPES for IRS. For example, test mortality rates of *An.gambiae* s.l. exposed to bendiocarb decreased from 95-97 percent in 2010 to 65-89 percent in 2011 and 58.6-78.6 percent in 2012. Further analysis to confirm insecticide resistance using polymerase chain reaction identified the Ace-I mechanism of resistance at low frequencies in the samples collected from five districts out of six. Kdr insecticide resistance was also found to be widely distributed in the study areas. However, the vector was found to be fully susceptible to the organophosphate insecticide primiphos-methyl. Further discussion

regarding insecticide selection for the 2013 IRS campaign will be completed in October and November, during post IRS campaign meetings between CREC, the NMCP, PMI/Benin, and AIRS Benin.

CREC also collected data on vector density, human landing rates, parity rates, sporozoite rates and entomological inoculation rates. The five month average (April-August 2012) indoor and outdoor human landing rates of the intervention area was 0.78 and 2.94 per person per night, respectively as collected by human landing catches. The indoor to outdoor ratio was 1:3.8, meaning the vector is more exophagic (i.e., tended to feed outdoors). On the contrary, in the control villages indoor and outdoor human landing rates were 6.125 and 3.6 per person per nights. The ratio of indoor to outdoor was 1.7:1, revealing the vector showed endophagic behavior (i.e., tended to feed indoor). Findings suggest that IRS has forced more vector-man contact to occur outdoors than indoors. Sporozoite rates were 8.27 percent in the control villages as compared to 2.36 percent in the intervention areas. Final analysis is yet to be made but quick observation of data shows low parity rates in the intervention areas as compared to the control villages. In general, IRS seems to have good impact in bringing down entomological transmission indicators including entomological inoculation rates, which is the measure of the force of transmission in an area, and parity rates, which is a measure of the longevity of mosquitoes in an area.

Program Highlights

The AIRS Benin IRS campaign marked the first time all nine districts in the Atacora Region have been sprayed by a PMI-supported IRS. AIRS Benin developed strong partnerships with PMI/Benin, the NMCP, the Ministry of Health, the Ministry of Agriculture and Fisheries, the Benin Environmental Agency, and the Atacora Regional Directorate of Health to complete the spray campaign. These partnerships proved to be key to the successful IRS campaign.

During geographic reconnaissance before the IRS campaign, AIRS Benin noticed that several communities that were sprayed in 2011 were within the boundaries of Pendjari National Park. Working with the spray campaign partners and PMI/Benin, it was decided to provide long-lasting insecticide-treated nets to these communities, instead of completing IRS.

Overall the spray campaign was implemented significantly under budget, as AIRS estimates the entire spray campaign (including the purchase of insecticides and personal protective equipment (PPE)) cost approximately US\$2.8 million. A financial analysis that AIRS will undertake in early 2013 will help to confirm the actual costs of IRS programming. After initial program reviews by the AIRS Benin and AIRS Core staff, it is estimated that savings were earned in the following ways:

- AIRS Benin was able to procure some PPE locally (including gloves for spray operators and washers, and helmets for spray operators and team leaders), which was more cost-effective than procuring the equipment internationally.
- AIRS Benin refurbished most of the soak pits and wash areas, as opposed to building completely new soak pits, at most operation sites used in 2011
- The AIRS Core team worked with the AIRS Benin M&E staff to improve the existing database used for M&E tracking in 2011 instead of developing a brand new database. Furthermore, the improved database was more efficient for data entry, and AIRS Benin only required 20 data clerks to enter all spray campaign data during the IRS campaign, 50 percent less than the 40 data clerks originally budgeted in the work plan.
- Due to the growing partnership with the Atacora Regional government, and their increased interest in IRS to help prevent malaria, AIRS Benin was able to use most store rooms and soak pits at the district and commune level for free. In most cases the district and commune government waived all rent payments during the IRS campaign.

- As the AIRS Benin team has proven themselves to be strong in planning, implementing, and monitoring all aspects of the IRS program, the team has required less STTA. Therefore several STTA trips, including a scheduled trip for environmental compliance and finance and administration were not needed in 2012. In fact, the AIRS Benin team was so strong that the AIRS Benin environmental compliance officer, operations manager, Chief of Party, and technical manager provided STTA to AIRS Burkina Faso, AIRS Madagascar, and AIRS Mozambique.
- AIRS had originally budgeted to complete the IRS campaign from the middle of May through the end of June. However, AIRS Benin was able to finish its IRS campaign on June 22, one week early.
- Due to the decision by PMI (after gaining guidance from AIRS Benin and the Ministry of Environment) not to spray 10,430 eligible structures located within the boundaries of the Pendjari Biosphere Reserve, labor and material costs were saved, along with savings in insecticide not used to spray these structures.

Challenges and Lessons Learned

More efficient use of transport is possible. Since transportation (specifically vehicle rental and fuel) is a significant line-item in the budget, it is important to use the least number of vehicles that can carry the most people and equipment. In 2012, AIRS Benin was able to reduce transport costs through the following:

- AIRS Benin based as many staff as possible in the Atacora region for nearly all of the spray campaign.
- AIRS Benin assured more efficient project staff trips to the spray areas, whereby AIRS Benin staff aimed to tackle several issues (such as observing environmental compliance and spray campaign operations) concurrently. This reduced the number of staff trips to the field, and decreased the need for vehicle rentals for staff trips.
- AIRS Benin staff traveled from Cotonou to Atacora via bus, which also led to cheaper fuel and maintenance costs, as AIRS Benin did not need to send project vehicles to Cotonou to pick up a single staff member, and transport this person to Atacora.
- AIRS Benin was also able to negotiate a better vehicle rental agreement than in previous years, and was able to realize a 4 percent cost-reduction in vehicle rental costs from the winning vendor.
- Finally, AIRS Benin added a new operation sites in 2012, at the Kaoubagou Health Center in Kerou District. Although the operation sites did not include a store room, the operation site did include a soak pit and washing area, and therefore allowed the spray teams covering remote areas in Kerou district to travel shorter distances to complete their daily post-spray activities (i.e., washing PPE, eliminating liquid wastes via soak pits, etc.).

1.3 BURKINA FASO

TABLE 3: AIRS BURKINA FASO AT A GLANCE

Number of provinces/districts covered by PMI-supported IRS in 2012	1 district (Diébougou)
Insecticide	Carbamate
Number of structures covered by PMI-supported IRS in 2012	36,870
Number of structures targeted by PMI-supported IRS in 2012	37,126
2012 spray coverage	99%
Population protected by PMI-supported IRS in 2012	115,638 (including 2,188 pregnant women and 23,118 children under 5)
Dates of PMI-supported IRS campaign	July 13, 2012–August 4, 2012
Length of IRS campaign	21 days
Number of people trained with USG funds to deliver IRS ⁴	332

⁴This is based on the PMI indicator definition. It includes spray personnel such as spray operators, team leaders, supervisors, and clinicians. It excludes data clerks, IEC mobilizers, drivers, washers, porters (who did not attend standard operating procedures training), pump technicians, and security guards.

Entomology

Abt Associates subcontracted IRSS/Centre Muraz to carry out entomological activities. IRSS/Centre Muraz performed cone bioassay tests on sprayed walls using WHO kits in four sites (Bagane, Bapla, Diébougou, and Loto) immediately after spraying (an average of five days after spraying) and one month after spraying. In tests conducted less than a week after spraying, the test mortality rates of the exposed mosquitoes, *An. gambiae* s.l., was 100 percent, confirming good quality of spraying. Similar tests were conducted one month after spraying to assess bio-efficacy of the sprayed insecticide, bendiocarb. The test mortality rate ranged from 99.7-100 percent in two sites, and 97.8-98.8 percent in the other two sites. Overall, bendiocarb remained effective one month after spraying in the IRS targeted areas of Burkina Faso.

The January 2011 insecticide resistance report submitted by the incumbent and conducted by IRSS/Centre Muraz, indicated 96 percent test mortality rates, which was the basis for the selection of bendiocarb for the 2012 IRS campaign. In 2012, IRSS/Centre Muraz also performed insecticide resistance tests in the districts of Diébougou and Dano (control village) for bendiocarb. The test mortality rate of the exposed vector, *An. gambiae* s.l., was 76.4 percent and 70 percent two weeks and one month after spraying in Diébougou district (IRS intervention area), respectively. According to the WHO 1998 resistance classification criteria this result falls in the resistance category. The test mortality rates for mosquitoes from the control villages in Dano district were 82 percent (according to the January 2011 report), 83.5 percent two weeks after spraying, and 84.25 percent one month after spraying. If consistent results are obtained in subsequent tests this year, it will provide preliminary data that *An. gambiae* s.l., in the IRS areas are rapidly developing resistance to bendiocarb.

Data on vector density and behavior has also been collected in both intervention and control areas. Preliminary data shows a decrease in indoor resting density, longevity, and indoor vector-man contact in the intervention areas after spraying as compared to control villages. These activities are continuous and it may be too early to try to make conclusions based only on two data points available so far.

Program Highlights

During the period covered by this report, AIRS Burkina Faso focused on planning and implementation of the IRS campaign, which was launched July 13, 2012. The project carried out micro-planning meetings at the national and district levels, completed pre-spray inspections in all 17 operational sites, submitted the Letter Report, procured goods locally and internationally, and conducted trainings for all IRS seasonal personnel.

AIRS Burkina Faso trained a total of 755 seasonal workers, including 332 spray personnel and 423 IEC mobilizers, washers, storekeepers, pump technicians, drivers, data clerks, and district staff.

Prior to the spray campaign, the project worked in collaboration with the NMCP's communication unit, the Directorate of Public Hygiene and Health Education, the Health Education and Sanitation Services at the regional level, and district-level Information and Education Communication and Sanitation Services offices to oversee the community sensitization and mobilization process (mainly conducted through door-to-door visits). The use of bicycles by IEC mobilizers proved to be a cost-effective way to conduct mobilization and reach hard-to-access areas.

Challenges and Lessons Learned

- AIRS Burkina Faso had to wait for an authorization letter from the Government of Burkina Faso in order to import carbamates. Delays in receiving this authorization in turn caused delays in receiving the insecticide, though it ultimately arrived a few days before the start of the campaign. Another international procurement shipment including extra spray pumps and PPE, arrived a few days after the start of the campaign despite having been ordered with sufficient lead time. This delay was caused by a lack of availability of cargo planes departing from Brussels, where the goods had to transit through before arriving in Burkina.
- Soak pit inspections were not conducted thoroughly by the AIRS Burkina Faso environmental compliance officer. Right before the start of the campaign, the team discovered that some of the sites had not been visited, and as a result, the project had to make last minute repairs to two soak pits and wash areas. In addition, AIRS Burkina Faso had to seek water suppliers to ensure that enough water was available at the operational sites.
- Insufficient coordination between IEC mobilization and spray activities. For instance, sometimes the spray operators would arrive to structures that either hadn't been mobilized, or simply lacked a household card.
- Late incinerator inspections. This should have been done prior to the campaign. Not doing so caused delays in incineration after the completion of IRS.
- Incomplete database reporting feature. As a result the first reports had to be produced manually.

I.4 ETHIOPIA

TABLE 4: AIRS ETHIOPIA AT A GLANCE

Number of provinces/districts covered by PMI-supported IRS in 2012	36 districts in the Oromia region		
	Round 1	Round 2	Total
Insecticide	Pyrethroid	Carbamate	N/A
Number of structures covered by PMI-supported IRS in 2012	265,106	282,315	547,421
Number of structures targeted by PMI-supported IRS in 2012	269,057	285,006	554,063
2012 spray coverage	99%	99%	99%
Population protected by PMI-supported IRS in 2012	698,898	807,375	1,506,273 (including 23,309 pregnant women and 225,875 children under 5)
Dates of PMI-supported IRS campaign	June 17, 2012–August 3, 2012	August 15, 2012–October 5, 2012	N/A
Length of campaign	40 days	35 days	N/A
Number of people trained with USG funds to deliver IRS	1,058	1,202	2,260

Note: This table does not include data on graduated districts. Twenty-four graduated districts in the Oromia region receive minimal technical assistance and procurement support from AIRS. Structures in graduated districts are not directly targeted for spraying under AIRS.

Entomology

Comprehensive entomological monitoring activities that include all the five PMI primary indicators have been conducted in Ethiopia. During the first phase of spraying, the overall mortality rate of susceptible mosquitoes exposed to deltamethrin-sprayed walls 1–3 days after the spray was 100 percent. One month after spray, mortality of susceptible mosquitoes was 100 percent. Two months after spray the test mortality rate of susceptible *An. gambiae* s.l. was 98.6 percent. However, during the third and fourth months of testing, the rate fell to 78 and 76 percent respectively, falling below the recommended 80 percent mortality threshold.

During phase two spraying, the mortality rate of susceptible mosquitoes exposed to bendiocarb-sprayed walls was 100 percent in the two tested sites one to three days after the spraying began. One month after spray, mortality remained at 100 percent. Insecticide resistance tests planned to inform the 2013 insecticide selection are ongoing. Data collection on vector density and behavior is also ongoing.

Program Highlights

The project implemented both rounds of IRS with high spray coverage and high quality of spraying. During the six months, the project completed two rounds of spraying covering 36 districts with full IRS support and providing minimal technical assistance to 24 graduated districts. Specifically, AIRS conducted training on IRS with carbamate chemicals for more than 80 health workers from the Oromia region, including 24 graduated districts. In addition, the project provided these districts with 1,025 pairs of boots and PPE for 1,000 spray operators.

In Kersa district, AIRS piloted a community-based IRS campaign during round two. As part of the pilot, AIRS employed health extension workers as team leaders in each of the 20 *kebeles* (an administrative unit of approximately 1,000 households) of the district. In addition, the project minimized the cost by using existing facilities as store rooms and constructing smaller soak pits to serve only the workers in a particular *kebele*.

At PMI's request, the project identified a local cement kiln and provided rough cost analysis for destruction of Ethiopia's stockpile of obsolete and deteriorating DDT waste. Next, AIRS will complete a cost analysis for the transportation and secure warehousing of all DDT waste in PMI-supported districts in a central location.

Challenges and Lessons Learned

- A national shortage of vehicles appropriate for IRS operations caused delay in the roll-out of both campaigns.
- The supervision system was not established to the detail required during the first spray round. However, for round two the team conducted inter-project coaching, assigned to each of the AIRS team supervisors a number of districts, and worked more closely with the health office supervisors to ensure effective supervision in round two.
- The stock management and tracking system was not properly functional in some districts. Between spray rounds, the team revised the training manual and supplied the store rooms with correct forms and ledgers.
- The Oromia state health department would not accept most planned technical assistance activities (microplanning, implementation of environmental compliance monitoring, etc.) to the 24 graduated districts unless the project was funding actual IRS operations. Currently, AIRS is conducting an assessment of their operational sites to plan for 2013 procurement and technical contributions that PMI and AIRS will discuss with Oromia health department officials.

I.5 GHANA

TABLE 5: AIRS GHANA AT A GLANCE

Number of provinces/districts covered by PMI-supported IRS in 2012	9 districts (Bunkpurugu/Yunyoo, Chereponi, East Mamprusi, Gushegu, Karaga, Saboba, Savelugu-Nanton, Tolon, West Mamprusi)
Insecticide	Pyrethroid: Bunkpurugu/Yunyoo, Chereponi, Gushegu, Karaga, Saboba Organophosphate: East Mamprusi, Savelugu/Nanton, West Mamprusi Pyrethroids and organophosphates: Tolon
Number of structures covered by PMI-supported IRS in 2012	355,278
Number of structures targeted by PMI-supported IRS in 2012	383,142
2012 spray coverage	93%
Population protected by PMI-supported IRS in 2012	941,240 (including 21,774 pregnant women and 188,696 children under 5)
Dates of PMI-supported IRS campaign	April 23–July 31, 2012
Length of campaign	60 days
Number of people trained with USG funds to deliver IRS	992

Entomology

As part of the entomological monitoring activities, monthly surveys were conducted in three of the nine districts sprayed (Savelugu/Nanton, Tolon/Kumbungu, and Bunkpurugu-Yunyoo districts) and one unsprayed district (Tamale metropolis). Results from the surveys conducted by the AIRS, Ghana Health Service, and Noguchi Memorial Institute of Medical Research joint team in the first six months of the year showed a high quality of spraying and an effect of IRS on entomological transmission indicators. Some of the results are presented below:

- The effect of the spraying on vector density was shown in the reduction in the number of indoor resting mosquitoes in the IRS areas compared to the control district. Average room densities recorded were 28 and 2 for the intervention districts of Tolon and Savelugu, respectively, compared to 46 for the control district Tamale. The impact was also observed in the reduction in parity rates of mosquitoes in the IRS operational areas compared to Tamale, indicating a reduction in mosquito longevity. The mean parity rates for the IRS areas Tolon and Savelugu districts for the period April to September 2012 were 47.65 percent, and 41.37 percent, respectively, while the control area (Tamale) had a mean parity rate of 64.81 percent.
- Entomological monitoring data suggests both the organophosphate and the pyrethroid insecticides were effective at killing vector mosquitoes. The cone bioassay tests conducted by exposing susceptible mosquito colonies to pyrethroid sprayed walls showed test mortality rates of 97-100 percent two days after spraying, 98 and 100 percent two months after spraying, and more than 90 percent three months after spraying. For organophosphates the first valid test was conducted two months after spraying. All attempts between the date of spraying and two months after spraying

failed due to high mortality rates of control mosquitoes even though sprayed walls were covered with clean cardboard. The percentage mortality for organophosphate sprayed wall surfaces was between 98.3 percent and 100.0 percent two months after spraying and more than 90 percent three months after spraying. No significant variation was observed in the percentage mortalities among the three different types of walls tested: wood, cement, and mud.

Program Highlights

A new formulation of insecticide, a longer-lasting organophosphate called Actellic 300CS, was introduced for IRS in Ghana in 2012. Households in areas where the Actellic 300CS was used responded favorably to the insecticide and the strong odor was even identified as a positive attribute. Spray operations started on April 23, 2012 for the six pyrethroid districts and on May 14, 2012 for the three organophosphate districts and ended on July 31, 2012 for all districts.

Several chiefs, community leaders and community members were invited to observe the wall bioassay tests. This served as an opportunity to educate community members on general misconceptions and perceptions on the IRS program. The test results assured community members that the spray teams were adept in the spraying techniques and correctly deposited the right amounts of insecticides on the wall surfaces.

Challenges and Lessons Learned

- Delays in the shipment of Actellic 300 CS forced the Ghana AIRS team to push back the start of spray operations by three weeks in three districts.
- An ethnic conflict in Bunkpurugu-Yunyoo caused AIRS to cease spraying in the entire district for one week and for an additional week in Bunkpurugu-Yunyoo sub-district.
- Storms in Chereponi destroyed some eligible structures and interrupted spray operations.

1.6 LIBERIA

TABLE 6: AIRS LIBERIA AT A GLANCE

Number of provinces/districts covered by PMI-supported IRS in 2012	14 districts located in 5 counties (Grand Bassa, Margibi, Montserrado, Bong, and Nimba)		
	Round 1	Round 2	Total
Insecticide	Carbamate: Margibi and Montserrado Pyrethroids: Grand Bassa, Bong, and Nimba	Carbamates	
Number of structures covered by PMI-supported IRS in 2012 around one	96,901	21,332	118,233
Number of structures targeted by PMI-supported IRS in 2012	99,236	21,790	121,026
2012 spray coverage	98%	97%	98%
Population protected by PMI-supported IRS in 2012	869,707	N/A ⁵	869,707 (including 47,786 pregnant women and 145,845 children under 5)
Dates of PMI-supported IRS campaign	March 23 – June 28, 2012	October 3 – November 9, 2012	N/A
Length of campaign	83 days	33 days	N/A
Number of people trained with USG funds to deliver IRS	665	153	808

⁵Data will be available once Round 2 is completed.

Entomology

The IRS program worked closely with the Vector Control Unit of the NMCP and the Liberia Institute for Biomedical Research to provide entomological monitoring of insecticide resistance and quality of spraying.

Six sentinel sites, four representing IRS and two representing non-IRS areas were selected to monitor mosquito densities, behavior, and insecticide resistance status.

Cone wall bioassays to assess the quality of spraying and decay rate of insecticides were conducted in the four intervention areas between 10 days and two months post-spraying. Both wild caught indoor resting adults and those reared from field collected larvae were used in the bioassays. Cone bioassays were conducted in all four intervention sites; two sprayed with bendiocarb and two sprayed with pyrethroid.

The cone bioassay test mortalities in Doemah and Franktown which were sprayed with bendiocarb were above 90 percent 10 days after spraying and 70 percent 60 days after spraying, which, according to WHO standards, suggested good quality spraying and that mosquitoes are susceptible to the carbamate insecticide. Also after the second spray cycle, similar results of greater than 90 percent mortality rate was observed in the carbamate sprayed area 17 days after spraying, also suggesting good quality of spraying.

The mortality rates in Bokay in Grand Bassa County and Palala in Bong County, areas sprayed with a pyrethroid, were less than 20 percent for cone bioassays at 10 days post spraying. These results suggested that exposed mosquitoes were either resistant to pyrethroids or the quality of spraying was poor. However, interpreting these results should be done with caution because mosquitoes used in cone bioassays in these

two areas (Bokay and Palala) were collected from Margibi County. This was necessary because of the close proximity of larval breeding sites in Margibi County to the LIBR insectary compared to either Bong or Grand Bassa. It was much easier to collect and rear large numbers mosquitoes from Margibi than Bong or Grand Bassa because of long distances between the two counties and the insectary.

The mortality rates in all susceptibility tests using WHO tubes against pyrethroid insecticides were less than 85 percent indicating resistance. Nevertheless, suspected poor quality of spraying causing the observed low mortality rates could not be ruled out. Therefore, the operation department increased supervision of spray operators to ensure standard spray procedures were followed and enforced. Also, more susceptibility tests were conducted on mosquitoes from pyrethroid sprayed areas, which confirmed the presence of pyrethroid resistance. As the lack of a colony of susceptible mosquitoes was a challenge, measures have been put in place to have a functional insectary for rearing a susceptible mosquito strain.

Program Highlights

IRS operations in the public sector started simultaneously in two of the four counties (14 districts) on March 23, 2012. The spray operations continued in the rest of the districts in phases and ended on June 30, 2012. A total of 102 teams composed of five spray operators sprayed in the public sector. Spray operations were monitored by AIRS staff, the NMCP, the Ministry of Health, and local officials. In an effort to build the capacity of local stakeholders, government officers from the NMCP, community health teams, and district health offices served as IRS supervisors in various districts. On average, it took 26 days to complete spraying in one site. The duration of operations varied with the size of the site and access to remote communities.

The IRS public-private sector partnership initiative involved Arcelor Mittal, an Indian mining company operating in Liberia. Spraying was conducted in two concession sites, Arcelor Mittal Buchannan in Grand Bassa County and Arcelor Mittal Yekepa in Nimba Country. AIRS Liberia provided training, insecticide, and spray tanks, while Arcelor Mittal in Liberia provided spray operators and paid the cost of spraying. Spraying in the private sector commenced on June 6 and ended on June 29.

Planning and training for 152 spray personnel required for the second spray cycle targeting two districts started in August 2012 and was completed by the end of September 2012.

Challenges and Lessons Learned

- Inappropriate PPE sizes leading to instances of non-compliance of spray protocols. To address this issue, AIRS staff provided spot reorientation to demonstrate the appropriate use of PPE and replaced PPE that did not fit or was of poor quality.
- Shortage of monitoring and evaluation (M&E) forms, particularly the malaria service cards, was due to low capacity of the supplier to print the amount ordered and provide timely delivery. Nevertheless, the logistic unit closely followed up with the supplier to expedite the delivery of the M&E forms.
- Difficulty spraying in concession areas. Progress was slow because Arcelor Mittal allocated insufficient spray operators, and many people refused to have their houses sprayed because the majority of people work in the mines and they tend to start their day shift very early in the morning. Despite these problems, a total of 848 structures were sprayed in the concession areas, protecting a population of 5,916 people of which 13 percent (753) and 2 percent (100) were children under five years of age and pregnant women, respectively.

1.7 MADAGASCAR

TABLE 7: AIRS MADAGASCAR AT A GLANCE

Number of provinces/districts covered by PMI-supported IRS in 2012	15 districts Central Highlands (Ambatofinandrahana, Ambohimahaso, Ambositra, Ankazobe, Anjozorobe, Betafo, and Mandoto) Southern (Amboasary, Ambovombe, Ampanihy, Bekily, Beloha, Betroka, Tolagnaro, and Tsihombe)
Insecticide	Carbamate: Ambatofinandrahana, Ankazobe, Anjozorobe, Betafo, Mandoto, Amboasary, Ambovombe, Ampanihy, Bekily, Beloha, Betroka, Tolagnaro, and Tsihombe Pyrethroid: Ambohimahaso and Ambositra
Estimated number of structures targeted for spray as reported in 2012 Work Plan	410,000
2012 spray coverage	N/A ⁶
Estimated population protected by PMI-supported IRS in 2012	1,800,000
Dates of PMI-supported IRS campaign	Central Highlands: November 17, 2012–December 22, 2012 Southern: January 3, 2013–February 8, 2013
Number of people trained with USG funds to deliver IRS	N/A ⁶

⁶This information will be available after the spray campaign is completed.

Entomology

AIRS Madagascar completed and submitted the final entomological monitoring report for the 2011 spray campaign in June 2012. The report confirmed that the main vector of malaria in the country, *An.gamabie* s.l., is susceptible to carbamates and pyrethroids. Therefore, these two insecticide classes will be used for the 2012 IRS campaign.

Additionally, AIRS Madagascar completed entomological monitoring following the emergency IRS campaign implemented by the Malagasy NMCP and The Global Fund to Fight AIDS, Tuberculosis and Malaria in July to assess vector density and behavior. The emergency IRS campaign was conducted to suppress malaria outbreaks that occurred in southern Madagascar due to a longer than usual cyclone season, which led to an extended rainy season. Overall, AIRS Madagascar found low vector densities in the emergency spray campaign areas during its entomological monitoring. This could either be due to environmental factors or the impact of IRS campaign. Since this entomological monitoring was completed for an unscheduled emergency IRS campaign, baseline data or data from a comparable control village was not collected, and AIRS Madagascar could not definitively note if the emergency IRS campaign or the end of rains was the cause of lower vector densities.

Program Highlights

Abt Associates officially took over the PMI-supported IRS program in Madagascar on May 1, 2012. AIRS officially opened a new office in early May and established warehouses in Ambositra, Ambovombe, and Antananarivo. AIRS Madagascar has hired 15 staff members, including the recent hire of Dr. Xavier Pitroipa, the former AIRS Burkina Faso COP, as the AIRS Madagascar COP.

AIRS Madagascar will begin the first round of the 2012 IRS campaign on November 19, which will cover seven districts in the Central Highlands. The second round of the IRS campaign will cover eight districts in southern Madagascar. The 2012 IRS campaign will be the first year of targeted spraying, where AIRS Madagascar will only spray *communes* (sub-districts within target districts) where malaria incidence rates

continue to be high. Other *communes* within the district will not be sprayed due to their low incidence rates. The decision on which *communes* to spray in the Central Highlands, was made by the Roll Back Malaria (RBM) vector control committee (consisting of the NMCP, AIRS Madagascar, PMI/Madagascar, Institute Pasteur, and Global Fund partners), based on an analysis of the following indicators per commune:

- Malaria incidence rates
- RDT positivity rates
- Slide positivity rates
- Data on the frequency of reporting of fevers at health centers
- Vector densities gained from sentinel sites during entomological surveillance throughout the Central Highlands

All of the malaria epidemiological data was provided by the NMCP and its M&E division. The entomological data was provided by the PMI-supported IRS program (AIRS Madagascar after May 1, and its predecessor before May 1), and data gathered from Global Fund-supported IRS programming. Several meetings of the RBM committee were completed throughout 2012, to discuss the indicators described above, and decide which *communes* would be the focus of the 2012 IRS campaign.

Due to the late start of the IRS campaign in November 2012, AIRS Madagascar has mostly completed IRS campaign preparation work in September and October. This includes establishing a new database and data entry system, refurbishing and establishing new operation sites in the Central Highlands, hiring spray campaign seasonal staff, and beginning to train seasonal staff. Baseline data and entomological monitoring data for the 2012 IRS campaign were not available for this report.

Challenges and Lessons Learned

- Hiring a COP proved to be difficult. Finding qualified Malagasy candidates with malaria experience was a challenge, and thereby AIRS needed to hire a third-country national.
- Increased cyclone activity and an extended rainy season in southern Madagascar led to a longer malaria transmission season. In 2012, the Malagasy NMCP, with support from The Global Fund to Fight AIDS, Tuberculosis and Malaria was completed an emergency IRS campaign, in several districts where a malaria epidemic occurred.

1.8 MALI

TABLE 8: AIRS MALI AT A GLANCE

Number of provinces/districts covered by PMI-supported IRS in 2012	3 districts (Baroueli, Bla, and Koulikoro)
Insecticide	Carbamates
Number of structures covered by PMI-supported IRS in 2012	206,295
Number of structures targeted by PMI-supported IRS in 2012	210,217
2012 spray coverage	98%
Population protected by PMI-supported IRS in 2012	762,146 (including 18,561 pregnant women and 145,953 children under 5)
Dates of PMI-supported IRS campaign	July 23, 2012–September 6, 2012
Length of campaign	45 days
Number of people trained with USG funds to deliver IRS	872

Entomology

Due to the political situation in Mali, PMI could not continue to contract the Malaria Research Training Center (as it is funded by the Government of Mali) to complete entomological monitoring for the IRS campaign. Thereby, AIRS Mali completed entomological monitoring for the 2012 IRS campaign. AIRS Mali purchased a shipping container for approximately US\$3,500, placed it on the AIRS Mali compound and established an insectary, where mosquito dissection, raising of susceptible strains of mosquitoes, and other entomological activities occurred. PMI/Mali praised AIRS Mali for the establishment of the insectary. “I personally visited the insectary and I was very impressed with the division of the rooms. I was also impressed to find a Malian entomologist who really had the know-how and who has backup from the AIRS headquarters staff,” said Jules Mihigo, resident advisor for President’s Malaria Initiative.

AIRS Mali conducted entomological monitoring and collected entomological data on all five PMI primary indicators as per the PMI technical guidelines. The WHO wall bioassay test, which aimed to assess the quality of spraying, was conducted within the first week of the start of spraying in four sites, Manabougou (Koulikoro district), Nieta (Bla district), Feya/N’dentila (Koulikoro district) and Bouadie/Kamba (Baraouli district). The test mortality rates were 97 and 100 percent for mosquitoes exposed to the sprayed walls in Manabougou and Nieta sites, respectively, indicating good quality of spraying in these two sites. However, the test mortality rates of mosquitoes exposed to houses sprayed in Feya/N’dentila and Bouadie/Kamba were 66 and 80 percent respectively. The susceptibility of the local *An. gambiae* s.l. population to bendiocarb was established through the WHO tube test prior to using local mosquitoes for the wall bioassay tests. Therefore, resistance couldn’t explain the low mortality rates observed in the two sites. Quality of spraying appeared to be the most plausible reason. Spraying was called off for one day and intensive refresher training was given to spray operators, team leaders, and supervisors in Feya/N’dentila and Bouadie/Kamba. They were then deployed again to do the spraying. Cone bioassay tests conducted in randomly selected houses sprayed by the same teams after refresher training showed test mortality rates of 100 percent, indicating improved quality of spraying.

Similar test were conducted one month after spraying to assess the residual efficacy of bendiocarb in all four sentinel sites. The average test mortality rates ranged from 91-96 percent one month after spraying. In the test conducted two months after spraying, the test mortality rates dropped below the 80 percent threshold to 32-54 percent. The residual life of bendiocarb seems shorter than expected in Mali. This might be linked to the pH level of the water or soil, or some other factor such as temperature. PMI, AIRS, and the manufacturer are working on problems related to the residual life of the insecticide.

Insecticide resistance tests were also conducted using *An.gambiae* s.l. mosquito samples collected from different areas of IRS targeted districts to inform insecticide selection for the 2013 IRS campaign. All four classes of insecticides recommended by WHOPES for IRS were represented in the study. The test mortality rates were 13-58 percent for lambda-cyhalothrin, 11-48 percent for DDT, 88-99 percent for bendiocarb and 97-99 percent for fenitrothion. Based on the susceptibility data, cost, operational feasibility, and availability of insecticide on the market, carbamates were recommended for the 2013 campaign. Susceptibility testing is being completed in December 2012 in 12 additional nationally representative sites to map insecticide resistance in Mali.

Entomological data on vector density and behavior has also been collected from control and intervention villages. Baseline data was collected prior to the start of spraying. Preliminary data shows a reduction of indoor resting density and indoor man vector contact in the intervention villages as compared to the control villages. However, more data is yet to be collected in order to make a fair conclusion of the impact of IRS on entomological indicators.

Program Highlights

In March 2012, the Government of Mali experienced instability, with the deposition of the president and the military taking control of government affairs. Following USG policy, USAID/Mali suspended program activities in Mali starting in April. Thus AIRS Mali ceased programming activities outside of its office in Bamako until further notice. Abt Associates received a letter of authorization to restart all IRS programming, under the AIRS Mali program, on June 21, 2012. After a quick preparation phase, AIRS Mali was able to initiate the 2012 IRS program on July 23. However, USAID instructed AIRS Mali to complete all IRS activities without the participation of the Government of Mali.

In response to these constraints, AIRS Mali increased its number of seasonal staff to complete supervision that would normally be undertaken by regional and district health officials, and formally engaged community health committees to help mobilize and organize IRS programming. The IRS campaign was completed in the three spray districts, Baroueli, Bla, and Koulikoro, on September 6. AIRS Mali improved the speed of IRS data collection and the ability to complete data quality controls by establishing a second data entry center in Segou, which is closer to Bla and Baroueli districts than the Bamako office.

Challenges and Lessons Learned

- Political instability caused IRS programming to start late.
- July is the start of the rainy season in Mali, and transporting spray operators was often affected by muddy and difficult roads. Additionally, the rains caused delays in spraying, as household members could not remove furniture from eligible spray structures until the rains ended.
- Due to the lack of time to prepare operational sites, the team was forced to make quick refurbishments to some of the operational sites. The AIRS Mali team was not able to do a pre-spray inspection at all 68 sites, but visited 12 sites that represented the geography of the various sites. Soak pits, storerooms, finishing areas, and shower/toilets were refurbished in some sites, but AIRS Mali was not able to ensure all 68 sites were compliant with all the environmental best practices. AIRS Mali will need to make significant improvements for the 2013 IRS campaign to all 68 operational sites.

I.9 MOZAMBIQUE

TABLE 9: AIRS MOZAMBIQUE AT A GLANCE

Number of provinces/districts covered by PMI-supported IRS in 2012	6 districts (Milange, Mocuba, Morrumbala, Namacurra, Nicoadala, and Quelimane)
Insecticide	Pyrethroids
Estimated number of structures targeted for spray as reported in 2012 Work Plan	608,344
2012 spray coverage	N/A ⁷
Estimated population to be protected by PMI-supported IRS in 2012	1,800,000
Dates of PMI-supported IRS campaign	October 8, 2012–November, 2012
Number of people to be trained with USG funds to deliver IRS	1,121

⁷This information will be available after the spray campaign is completed.

Entomology

In April, AIRS Mozambique conducted vector susceptibility testing in order to inform the insecticide selection for the 2012 campaign. *An. gambiae* s.l. mosquitoes were collected and reared to adults. Then, they were exposed to deltamethrin and lambda-cyhalothrin insecticides to assess their susceptibility levels. The test mortality rates were 100 percent for deltamethrin and 90 percent for lambda-cyhalothrin. Since the test mortality rates ranged from 90 to 100 percent, AIRS Mozambique recommended pyrethroids for this year's campaign.

AIRS Mozambique hired an entomologist who is seconded to the NMCP to support its entomological surveillance activities. In addition, consultant Dr. Meshesha Balkew went to Mozambique in September to conduct the entomological baseline activity and to train local staff on pyrethrum spray collections and human landing catches, among other activities. He trained 35 technicians on basic entomological monitoring activities, focusing on practical exercises.

Program Highlights

Between April and September 2012, AIRS Mozambique focused on planning activities for the 2012 IRS campaign. Some of the most important activities included inventory assessment, micro-planning meetings at the national and district levels, major renovations of 38 operational sites (including storerooms, soak pits, and wash areas), pre-spray environmental inspections of all sites, submission of the Letter Report, revision and printing of all IEC forms, brochures, and IRS data collection tools, local and international procurements, and training of seasonal personnel. AIRS Mozambique trained more than 1,000 people including spray operators, IEC mobilizers, IRS supervisors, data clerks, pump technicians, washers, storekeepers, and guards. During this period, AIRS Mozambique also recruited an environmental compliance officer based in the Quelimane office, and a finance and administration (F&A) manager based in Maputo.

The AIRS Benin operations manager, Eugene Kiti, went to Mozambique in early September to provide technical assistance and share Benin's management tools and lessons learned with the Mozambique operations team. Furthermore, the team conducted combined mobilization/enumeration during the months of August and September, which led to a more accurate count of eligible structures than population-based estimations. In late September, one month before the beginning of the campaign, the AIRS operations director, Allan Were, provided in-country support to the operations team in Quelimane to ready them for the launch of the spray campaign. He provided on-the-job training on performance tracking tools, stock management, and other related areas.

Challenges and Lessons Learned

One of AIRS Mozambique's greatest challenges involved renovating 38 operational sites. Given that the inherited sites were in very poor condition, renovation required significant time and resources. The team also had to hire pump technicians to repair over 800 pumps that were malfunctioning due to improper care during transportation in previous campaigns. In addition, mobilization and enumeration took longer than expected, as did the recording of the data in the project's database. Lastly, the start date of the campaign was changed twice as requested by the Provincial Health Directorate.

1.10 NIGERIA

TABLE 10: AIRS NIGERIA AT A GLANCE

Number of districts covered by PMI- supported IRS in 2012	2 LGAs (Doma and Nassarawa Eggon)
Insecticide	Pyrethroid
Number of structures covered by PMI-supported IRS in 2012	58,704
Number of structures targeted by PMI-supported IRS in 2012	59,229
2012 spray coverage	99%
Population protected by PMI-supported IRS in 2012	346,115 (including 15,900 pregnant women and 62,584 children under 5)
Dates of PMI-supported IRS campaign	April 4, 2012–May 30 2012
Length of campaign	32 days
Number of people trained with USG funds to deliver IRS	351

Entomology

AIRS used WHO cone assays to test the quality of spraying with the pyrethroid alphacypermethrin. Adult mosquitoes reared from field-collected larvae and pupae were used for the test due to the absence of a susceptible colony. It was assumed that the vector was susceptible to pyrethroids based on 2011 resistance data. The average 24-hour post-spray mortality was 94.7 percent for the month of April, one week after spraying. However, the mortality rate dropped to 72.5 percent for May one month after spraying, and 22.1 percent for July two months after spraying. Noticing that insecticide efficacy rates were unexpectedly low the project conducted CDC bottle bioassays to confirm that local *An. gambiae* s.l. was susceptible to alphacypermethrin. The result confirmed that the vector was susceptible to the sprayed insecticide. A more comprehensive susceptibility test for all four classes of insecticides was conducted in October 2012 as planned to inform 2013 insecticide selection. The October 2012 results showed full susceptibility to organophosphates and carbamates (100 percent mortality rates for both), and some emerging pyrethroid resistance (84-100 percent mortality rates).

In order to develop a more sustainable system of collecting entomological data, the team has initiated discussions with three public universities to identify a location to build an insectary. AIRS has developed a procurement list and created job descriptions for the insectary technician and the project entomological coordinator.

Program Highlights

During this period, the project completed the spray campaign in two local government areas (LGAs) of Nasarawa State. The project conducted post-spray inventory assessment, held the end-of-spray conference, and incinerated all solid waste accumulated during the campaign. The team obtained approval from PMI/Nigeria and the National Malaria Vector Control Program on the definition of structures, which will be used to guide the 2013 spray round. The team developed a protocol for a post-spray data quality audit with actual audit visits to be completed by the end of 2012. AIRS Nigeria drafted an MOU between the project and the state administration and developed a concept note to be presented to the state governor on opportunities for local ownership of IRS. The note will be presented by the end of 2012.

Due to rapid decay of the alphacypermethrin (Fendona) in sprayed structures, the project requested the insecticide distributor to conduct quality control tests on the batches shipped to Nigeria. Routine independent quality tests done at the South African Bureau of Standards (SABS) laboratory post-shipment indicated that some batches of the insecticide were slightly off-specification. Parallel tests done at two other laboratories selected by BASF indicated that overall the samples tested were just within standard specification. Based on these results, the quality of the insecticide, the quality of spraying, or a combination of both could have contributed to the poor insecticide efficacy.

Challenges and Lessons Learned

- Halfway into the campaign AIRS Nigeria experienced a two-week interruption because of an insecticide stock-out due to the incorrect measurement of an average structure size used for quantification during the planning stage. Based on this experience, the Nigeria team adjusted the average structure size and the global AIRS project determined that all future insecticide procurements would include a 20 percent buffer versus the original 10 percent.
- AIRS faced environmental compliance issues with PPE, store room equipment, and spray operator mobilization. Specifically, issues included lack of first aid kits in stores, poor quality gloves, inappropriate boot sizes for a few operators, and lower turnout of spray operators than expected. These inadequacies occurred during the first days of spraying. The team addressed the issues by supplying missing materials and correct size PPE, and also conducting orientation meetings for spray operators.
- Establishing productive relations with the state authorities proved difficult. The team developed a rigorous advocacy plan to engage the government stakeholders and encourage state ownership of IRS.
- Payment procedure and expense documentation issues with the entomological monitoring subcontractor caused delays in reporting collected data. In some cases, the subcontractor did not fully followed research protocols, which jeopardized the coherence of data collection and the entomological monitoring process.
- As a result of the unexpectedly rapid decay of Fendona, AIRS will require the manufacturer to forward samples from each batch of the insecticide to SABS. They, in turn, will provide a test report for each batch of product tested. The report will be dated and must state whether or not the batch meets the applicable WHOPES and/or manufacturer specifications.

1.11 RWANDA

TABLE 11: AIRS RWANDA AT A GLANCE

Number of provinces/districts covered by PMI-supported IRS in 2012	3 districts (Bugesera, Gisagara, and Nyagatare)
Insecticide	Pyrethroids
Estimated number of structures targeted for spray as reported in 2012 Work Plan	240,000
2012 spray coverage	N/A ⁸
Estimated population protected by PMI-supported IRS in 2012	1,031,816
Dates of PMI-supported IRS campaign	August 21–22, 2012 September 17–October 18, 2012
Number of people trained with USG funds to deliver IRS	1,986

⁸This information will be available after the spray campaign is completed.

Entomology

Baseline vector studies were conducted prior to IRS to assess the vector species, density, and behavior. The results showed a predominance of *Anopheles gambiae* s.l. In collaboration with the Malaria Division of the National Malaria Control Program, WHO cone bioassays testing susceptible mosquitoes were conducted within one week of spraying to assess the quality of spraying. The recorded mosquito mortalities ranged from 95.8 to 99.3 percent, showing good spray quality.

Program Highlights

AIRS Rwanda conducted all of the standard pre-spray activities including renovating of soak pits to meet environmental compliance standards, conducting enumeration, training seasonal staff, and completing IEC activities. Spraying occurred for two days at the end of August and then resumed mid-September. Once spray operations re-started in September, they ran smoothly. A full report of the Rwanda spray activities will be included in the next semi-annual report.

Challenges and Lessons Learned

The biggest challenge that the Rwanda AIRS team faced was the unfortunate death of a spray operator on August 21. Spray operations were ceased immediately and Abt Associates, PMI, and the NMCP worked to investigate the incident. The investigation indicated that the cause of death was not due any adverse effects from insecticide, and Abt Associates was cleared to begin spraying again. This incident and investigation resulted in a substantial delay in spray operations. Enhanced precautions were taken to prevent such an incident from occurring again. For example, team leaders were required check the health status of their spray operators in the morning and report any health problems to their supervisor immediately. Spray operators showing symptoms of fatigue, headache, and flu are not allowed to work on that day and are advised to seek medical attention at the nearest health facility. Daily briefings of spray operators to pay greater attention to personal safety were instituted, and spray operators are encouraged to report any symptom to their team leaders and sector coordinators.

1.12 SENEGAL

TABLE 12: AIRS SENEGAL AT A GLANCE

Number of provinces/districts covered by PMI-supported IRS in 2012	6 districts (Guinguinéo, Koungeul, Koumpentoum, Malem Hodar, Nioro, and Vélingara)
Insecticide	Carbamates
Number of structures covered by PMI-supported IRS in 2012	306,916
Number of structures targeted by PMI-supported IRS in 2012	312,938
2012 spray coverage	98%
Population protected by PMI-supported IRS in 2012	1,095,093 (including 26,263 pregnant women and 220,463 children under 5)
Dates of PMI-supported IRS campaign	June 6, 2012–September 3, 2012
Length of campaign	66 days
Number of people trained with USG funds to deliver IRS	1,097

Entomology

The vector and parasite ecology laboratory of Cheikh Anta Diop University of Dakar (Université Cheikh Anta Diop de Dakar, UCAD) supports entomological monitoring for the IRS program. During the writing of this report, results from UCAD's entomological monitoring work were still being validated.

Program Highlights

Between April and September 2012, AIRS Senegal focused on planning activities and implementing the IRS campaign. Activities included micro-planning at the national and district levels, coordinating with ChildFund Senegal (IEC implementer), vetting and revising IEC tools, preparing local and international procurements, performing pre-spray inspections, submitting the Letter Report, and training IRS seasonal personnel. AIRS Senegal trained and hired a total of 1,483 seasonal workers including spray operators, team leaders, site managers, pump technicians, washers, storekeepers, guards, water suppliers, district coordinators, and logistics assistants.

AIRS Senegal worked closely with the NMCP, the National Hygiene Service, the Regional Directorate for the Environment, and the district health management teams (DHMTs) to provide close supervision on all aspects of the campaign including mid- and post-spray environmental inspections. Upon completion of the campaign, AIRS conducted the district- and national-level end-of-spray round conferences in conjunction with the NMCP and DHMTs. The Bethesda-based technical coordinator, Mariandrea Chamorro, visited Senegal in June for the spray campaign and in September to attend the national end-of-spray conference. Abt's subcontractor, RTT Group, Ltd (RTT) also conducted short-term technical assistance in June to assess the country's stock management practices, warehouses, and supply chain logistics.

Challenges and Lessons Learned

The AIRS Senegal team faced a number of challenges during the 2012 spray campaign. The primary challenge faced by the team was improper insecticide quantification. The team initially miscalculated the total number of structures to be sprayed when converting "pieces" (or rooms) to "structures". In addition, a general underestimation of the number of structures to be sprayed, particularly in the new district of Koungeul, contributed to two insecticide stock-outs towards the end of the campaign, which in turn delayed the spray campaign approximately two weeks. Lastly, weak on-the-ground supervision and tracking of insecticide use at the site level also contributed to the unfortunate stock-out scenarios. To remediate the stock-outs, AIRS Senegal borrowed insecticide from Mali and Benin. Despite this major challenge, AIRS Senegal ultimately exceeded its targets and achieved a 98 percent coverage rate. AIRS Senegal will put better quantification,

supervision, and insecticide tracking systems in place next year in order to avoid stock-outs based on major lessons learned in 2012.

Other challenges faced during this campaign included:

- Tardy or ineffective dispatching of IRS commodities, including some PPE.
- Lack of clarity and coordination regarding IEC mobilizers' and spray operators' roles and responsibilities, and poor distribution and completion of IRS household cards by mobilizers and spray operators.
- Weak senior management supervision during the first week of the campaign. All senior managers should have been deployed in the different districts for the start of the campaign and this was not the case. This will be corrected in time for next year's campaign.
- Lack of clarity with districts and NMCP before the start of operations on the decision to not conduct medical check-ups for spray operators at the end of the campaign. NMCP and district staff demanded that medical check-ups be conducted as they had been in past campaigns. AIRS on the other hand, wanted to eliminate post-spray check-ups based on the most recent WHO guidance, stating that carbamates are to be considered low risk insecticides, and therefore only an initial medical exam was necessary. However, recognizing the lack of clarity and in order to appease political demands, AIRS moved forward with conducting post-spray medical check-ups this year, following PMI/Senegal's guidance. Next year, AIRS Senegal will ensure that NMCP is on board with this new protocol and the team will make it clear to all those involved in the campaign from its inception.
- Three livestock and eight humans experienced adverse effects from IRS during the 2012 campaign. The people affected were promptly treated and have fully recovered; livestock did not survive. All these incidents were properly documented, investigated and reported to PMI. AIRS will take necessary actions, including more strict spray operator supervision, in the next spray round to prevent incidents of livestock or human poisoning.

1.13 ZAMBIA

TABLE 13: AIRS ZAMBIA AT A GLANCE

Number of provinces/districts covered by PMI-supported IRS in 2012	20 Eastern Province: Chadiza, Chipata, Katete, Lundazi, Mambwe, Nyimba, Petauke Muchinga Province: Chama, Chinsali, Isoka, Mpika, Nakonde Northern Province: Chilubi, Kaputa, Kasama, Mbala, Mporokoso, Mpulungu, Mungwi, Luwingu
Insecticide	Carbamates: Muchinga Province, Northern Province Organophosphates: Eastern Province
Estimated number of structures targeted for spray as reported in 2012 Work Plan	531,791
2012 spray coverage	N/A ⁹
Estimated population protected by PMI-supported IRS in 2012	2,486,123
Dates of PMI-supported IRS campaign	October 15, 2012–December 2012
Number of people trained with USG funds to deliver IRS	N/A ⁹

⁹This information will be available after the spray campaign is completed.

Program Highlights

During the period covered by this report, AIRS Zambia continued post-spray inspections and waste disposal for the sites sprayed in 2011 and inspected the operational sites of the districts identified for the 2012 IRS campaign. USAID's office of the Regional Inspector General conducted an audit of USAID/Zambia's PMI-funded commodities. Inspectors interviewed AIRS and Zambia Integrated Systems Strengthening Program (ZISSP) project staff and visited several operational sites. The audit team shared their findings with the two projects, which have jointly addressed identified issues. The AIRS project ensured timely and successful delivery of insecticides (carbamates and organophosphates) and procured all required PPE and spray equipment. Abt Associates' subcontractor, RTT, conducted pesticide stock control and inventory management training for 63 representatives from spray districts, including store keepers and district supervisors.

Challenges and Lessons Learned

The addition of seven new districts, which had never received PMI support for IRS, to the 2012 spray campaign caused two-week delays in spray operations in the new districts. Specifically, AIRS had to quickly produce and obtain approval for an amendment to the 2010 Supplemental Environmental Assessment, which had already been amended once in 2011.

1.14 ZIMBABWE

TABLE 14: AIRS ZIMBABWE AT A GLANCE

Number of districts covered by PMI-supported IRS in 2012	17 districts Manicaland: Buhera, Chimanimani, Chipinge, Makoni, Mutare, Mutasa, and Nyanga Mashonaland East: Mudzi, Murewa, Mutoko, and UMP Mashonaland West: Chegutu, Hurungwe, Kadoma, Kariba, Makonde, and Zvimba
Insecticide purchased by AIRS	Pyrethroids
Estimated number of rooms targeted for spray as reported in 2012 Work Plan ¹²	1,012,927
2012 spray coverage	N/A ¹¹
Estimated population protected by PMI-supported IRS in 2012	1,462,512
Dates of PMI-supported IRS campaign	October 1, 2012–December 22, 2012
Number of people trained with USG funds to deliver IRS	N/A ¹¹

¹¹This information will be available after the spray campaign is completed.

¹²The Zimbabwean NMCP tracks “rooms” as opposed to “structures” as the geographic indicator for the residential space covered by IRS campaigns.

Entomology

The 2012 IRS campaign will begin in October; therefore, AIRS Zimbabwe will begin its entomological monitoring in late 2012, and will provide updates in the next semi-annual report.

Program Highlights

The AIRS Zimbabwe project officially opened its office in Harare, in May 2012. In July, the program hired its COP/Entomologist, Dr. Ron Masendu. Since the Zimbabwean NMCP has several decades of experience in operating and managing IRS throughout the country, the AIRS Zimbabwe program will only provide technical assistance, and provide operations, environmental compliance, and entomological monitoring for the IRS campaign. Additionally, although IRS operations span Zimbabwe (with areas in the south and the highlands nearing malaria elimination), AIRS is limited to supporting the 17 districts in Mashonaland East, Mashonaland West, and Manicaland, where PMI has committed support.

Over the first five months of the program, AIRS Zimbabwe has helped to initiate environmental compliance training within the government IRS and spray operator trainings. This has led to AIRS Zimbabwe planning and organizing for building soak pits for the safe disposal of liquid wastes in the 17 PMI-supported districts. Results of the soak pit construction, in addition to information from AIRS monitoring of environmental compliance and IRS operations, will be listed in the next semi-annual report.

Challenges and Lessons Learned

AIRS Zimbabwe has had difficulties communicating with the NMCP, and therefore the NMCP has not fully understood the purpose of the AIRS Zimbabwe program. The difficulties in communication relate to:

- The AIRS Zimbabwe COP has not done an adequate job building relations with the NMCP and malaria partners.
- PMI/Zimbabwe staff have been in-country for a short time period and are still developing relationships with the NMCP.

- Since the provincial and district health offices have considerable influence over health programming, including malaria control, it is necessary to engage all levels of the health system to better ensure their understanding of the AIRS project. This has required more effort than AIRS Zimbabwe was able to complete, with only three staff members; however AIRS could have done a better job to plan for completing outreach (via a training, workshop, meetings, etc.) with district and provincial health offices.

AIRS Zimbabwe aims to better engage the NMCP in the future, and gain a better understanding of what are the strong needs of the Zimbabwean IRS campaign. Since IRS campaigns have been organized in Zimbabwe for several decades, providing the standard PPE and insecticide that is normally procured for IRS campaigns (and which AIRS Zimbabwe provided to the NMCP for the 2012 IRS campaign), may not be the greatest need of the NMCP and the Zimbabwean IRS program.

In 2012, the NMCP expressed the need for repairing IRS campaign vehicles, and buying tires for trucks that transport IRS materials. Given that the NMCP has PPE in-stock, providing transport assistance may have been more meaningful to assisting the 2012 IRS campaign. Additionally, AIRS Zimbabwe could be of service in the future to help improve the current system that provides daily IRS campaign data to the NMCP, to allow for better analysis of IRS campaign progress.

AIRS Zimbabwe is in the process of getting signatures on an agreement with the NMCP. The agreement will specify the responsibilities of AIRS Zimbabwe with regard to the 2012 IRS campaign and the ownership of equipment and the insecticide after they are handed over to the NMCP, and require that the NMCP will follow and improve environmental compliance in the PMI-supported districts. The initial agreement was sent to the NMCP in August and has not been signed yet.

2. CORE ACTIVITIES

2.1 ENTOMOLOGY

The following key activities have been performed to strengthen entomological monitoring work and support program decision-making with entomological evidence.

TRAINING

In order to build entomological monitoring capacity among field staff, AIRS organized a regional malaria entomology orientation and training for in-country technical managers and entomology coordinators on April 17–19, 2012 in Adama, Ethiopia. Twelve participants attended from the following countries: Angola, Benin, Ethiopia, Ghana, Liberia, Madagascar, Mozambique, Nigeria, and Senegal.

The key objectives of the orientation and training were:

1. Provide a platform for experience and best practice sharing among AIRS countries technical managers/entomologists on entomological monitoring methods including mosquito sampling, species identification, cone wall bioassays, and insecticide resistance monitoring.
2. Update participants on PMI's technical guidance with respect to entomological monitoring and insecticide resistance management.
3. Discuss PMI's entomological monitoring and reporting requirements using AIRS country work plans as examples.
4. Discuss and finalize draft entomological monitoring data collection tools, including the PMI entomology database.
5. Bring all the technical managers and entomologists from all AIRS countries and the home office together to facilitate both vertical and horizontal communications to advance the quality of entomological work.

As a testament to the value of this training, participants arranged a separate experience sharing session of their own one evening and held a lively discussion. At the completion of training, participants were asked to evaluate the training. On average, participants rated the training as having "more than met" their expectations. The training provided an opportunity to develop an excellent working relationship among the attendees.

STUDY OF THE RELATIONSHIP BETWEEN WATER PH AND RESIDUAL EFFICACY OF CARBAMATES

WHO wall bioassay test results from Mali and Ethiopia conducted in 2011 indicated short residual life of bendiocarb. These results stimulated discussion within PMI and between PMI and Abt. The pH of the water used for mixing of the insecticide prior to spraying was identified as one of the possible reasons for short residual life of bendiocarb. This is because there are data that show rapid break down/ hydrolysis of pesticides when mixed with water with high pH (University of Nevada, fact sheet FS-02-36). Abt Associates was then requested by PMI to lead the investigation in experimental huts in Ethiopia.

AIRS Ethiopia is conducting cone bioassays through October 2012 to test the efficacy of two carbamates (propoxur and bendiocarb) in different pH levels of spray water and on different wall surfaces (dung and mud). The purpose is to investigate the cause of rapid decay of carbamate class insecticides. Preliminary findings show that wall surface was more associated with low residual life of carbamates than the pH of the water. Specific results are:

- pH of spray water had little effect on the decay of the insecticides.
- Both carbamates showed signs of deterioration – one month after spray in mud coated walls and two months after spray in dung coated walls.
- Propoxur performed better than bendiocarb.
- Although there is nearly no difference in pH between dung and mud wall surfaces, both insecticides performed better on dung-coated surfaces.

In addition, PMI, Abt, and the insecticide manufacturer held a discussion to find ways to improve the residual life of bendiocarb. Action points have been identified and will be part of the 2013 core work plan.

ENTOMOLOGICAL MONITORING DATABASE

AIRS has helped finalize the development of an entomological database for insecticide resistance and cone bioassay tests with the objective of standardizing entomological data to be collected across all IRS countries supported by PMI. Data collection tools for vector density, behavior, and longevity evaluation are also being developed, and work has been started to include these tools in the entomological monitoring database.

In addition to collecting the same entomological data across all AIRS countries, data gathered from the entomological database could be used to make a multi-country analysis to better understand the dynamics of insecticide resistance and vector bionomics.

2.2 REGIONAL ENVIRONMENTAL COMPLIANCE TRAINING

Training was held in May 2012 in Mozambique for environmental compliance officers and operations managers from Angola, Liberia, Madagascar, Mozambique, Rwanda, Zambia, and Zimbabwe. The primary objective was to provide training on the requirements of U.S. regulation 22 CFR 216 regarding environmental health and safety for IRS operations. Participants also discussed national laws, regulations, and other requirements pertaining to each country, and how they affect our operations and procedures. AIRS staff spent considerable time discussing the PMI BMP and its applicability in each country. Training also covered the physical requirements for storehouses, wash areas, and soak pits as detailed in the manual, as well as the in-country SEA and any other national requirements. Participants learned about the system required for pre-, mid-, and post-spray reports, and developed standardized checklists for the inspection of storehouses, wash areas, and soak pits. Finally, participants discussed how to prepare Letter Reports and amendments to SEAs.

2.3 M&E TRAINING

A third M&E training (for lusophone countries) was held in Maputo, Mozambique from May 2–5, 2012. Staff from Angola, Madagascar, and Mozambique attended.

Participants were asked to complete evaluation forms to improve future trainings. On average, participants felt the training “more than met” their expectations. Additionally, self-ratings of participant knowledge, understanding, and capability on covered topics significantly improved after the training. It is noteworthy that one of the most common responses noted on the evaluations was that the participants were very glad to have been brought together and learned from each other’s experience. They exchanged contact information

and have since continued to collaborate with one another from their respective country offices. In response to the request from the previous M&E training in February, the training in Mozambique was extended from three to four days.

2.4 F&A TRAINING

In April 2012, nine finance and contract analysts from eight AIRS field offices (Angola, Benin, Burkina Faso, Ethiopia, Mali, Mozambique, Rwanda, and Senegal) traveled to Bethesda, Md., to receive training on IRS finance and international accounting. Abt Associates sponsored three days of training with other Abt Associates country office finance and contract analysts. Then, AIRS sponsored an additional two-day training only for project staff. At this time, field staff had the opportunity to work one-on-one with their home office counterparts. The training helped AIRS staff to improve the quality of financial management on the project through more detailed tracking and coding of expenditures.

2.5 COP CONFERENCE AND AIRS RETREAT

In June 2012, AIRS COPs traveled to Bethesda, Md., for a five-day leadership and management training sponsored by Abt Associates. The COP conference is an annual event that all Abt COPs attend.

Taking advantage of the COPs' presence at the Abt Associates home office, AIRS sponsored a two-day project retreat following the COP conference for COPs and AIRS home office staff. Sessions discussed project technical areas as well as capacity building, USAID compliance, and home office resources. In addition, COPs who had completed spraying shared best practices and lessons learned with COPs who were preparing their 2012 spray campaigns.

2.6 HOME OFFICE STAFFING

AIRS has hired several new home office staff to increase the project's capacity in the areas of communications, F&A, procurement, and M&E.

Beth Brennan, M&E specialist. Beth supports M&E efforts for Angola, Burkina, Liberia, Mali, Rwanda, Senegal, and Zambia.

Ilaha Gadjeva, procurement assistant. Ilaha supports the procurement manager and serves as a liaison among in-country F&A staff, vendors, and technical coordinators. She helps ensure smooth processing of the many AIRS procurement requests and payments.

Erin Schiavone, communications specialist. Erin is contributing to AIRS communications and knowledge management, including developing a strategic communications plan, creating content for and managing the AIRS website, and improving internal knowledge sharing tools.

Angela Sanchez, senior finance and contracts analyst. Provides part-time home office administrative, financial, and operational support for AIRS's core activities and collaborates on corporate financial planning and reporting requirements.

2.7 QUALITY ASSURANCE TESTING FOR INSECTICIDE

Abt Associates signed an agreement with the South African Bureau of Standards (SABS) to carry out pre-shipment quality testing of all batches of insecticides procured for AIRS countries. The agreement came into effect on September 17, 2012. Previously, AIRS worked with insecticide manufacturers to provide samples to the SABS laboratory for post-shipment testing of samples from all the batches of insecticides already procured. Testing was done for insecticides supplied by Bayer and Avima/BASF. Testing of the organophosphates procured could not be carried out because the methodologies are yet to be shared by the manufacturer, Syngenta/Arysta Lifescience.

2.8 CAPACITY ASSESSMENT

The AIRS project continues working on the Country Capacity Assessment. The framework and indicators are drafted and ready for final expert review and testing in three AIRS countries, which most likely will be Benin, Rwanda, and Senegal. The results of the assessment will provide an informed, albeit subjective, rating of the level of capacity currently existing by technical or operational area. The categories include entomological monitoring, environmental compliance, pre-spray planning, spray operations, procurement and supply chain logistics, and M&E. The project aims to complete the assessments in all AIRS countries within the first quarter of 2013.

2.9 AIRS PERFORMANCE MANAGEMENT PLAN

The Performance Management Plan (PMP) presents the strategy and indicators that the AIRS project will use to monitor and evaluate progress across each of the project's five technical components. The PMP provides a framework for systematically collecting process and output data to measure progress in project implementation at the country level and performance of overall project component objectives.

The AIRS project team will conduct annual reviews of the PMP to assess its continued effectiveness in measuring progress toward project results. Core indicators will be assessed according to the current data needs of PMI, AIRS project managers, NMCPs, and other local partners. Any edits to the PMP that are found to be necessary will be submitted to PMI/Washington for approval.

2.10 M&E DATABASE DEVELOPMENT

In order to provide a degree of standardization and data quality control, a single "core" Microsoft Access database has been developed for the AIRS project by Abt Associates' Client Technology Center. The database allows for some customization by individual country, yet maintains a high-quality design standard by having a centralized and vetted team responsible for development.

Since April, the database has been deployed to six additional countries (Angola, Burkina, Ethiopia, Madagascar, Mozambique, and Rwanda) for a total of eight countries using the AIRS core database. With each additional database roll-out, iterative improvements were made to the design, installation, storage/backup, and reporting protocols. Lessons learned were used to improve processes and ensure easier use in the field.

2.11 WEBSITE

AIRS staff wrote content, and worked with graphic designers and web developers to create a project website. The goal of the website is to serve as a project resource where visitors can read project success stories, track AIRS progress against our indicators, and find recent IRS research and tools. The site will launch in October.

2.12 SOUTH-SOUTH EXCHANGES

AIRS is fostering knowledge sharing through mentoring among Africa-based staff. AIRS Benin operations manager, Eugene Kiti, recently completed an assignment in AIRS Mozambique to share operational, logistics, and supervision tools as well as lessons learned from the 2012 Benin IRS campaign. Similarly, AIRS Angola recently benefited from the expertise and sound technical advice provided by Williams Abilia, the AIRS Ghana environmental compliance officer. AIRS Burkina Faso received support from the AIRS Benin environmental compliance officer, Damien Kodjo. These assignments are a testament to Abt's emphasis on building capacity and leveraging resources to strengthen the competencies of the select cadre of personnel that are implementing PMI-funded IRS programs across Africa. Eugene, Williams, and Damien all made substantive contributions and recommendations to their fellow AIRS colleagues, which will in turn contribute to improved performance during the implementation of IRS.

2.13 INSECTICIDE AND EQUIPMENT PROCUREMENT

The AIRS project issued a tender Request for Quotation (RFQ) for pyrethroids in four AIRS country programs. This tender was awarded to Bayer (PTY) Ltd and quantities were delivered to all countries. AIRS also issued a tender RFQ for carbamates for Madagascar, which was also awarded to Bayer (PTY) Ltd. Appendix A details all international procurements ordered and delivered during this reporting period.

2.14 SUB-CONTRACT PARTNERS

All sub-contract work performed by RTT during the period of this report is included and budgeted in country work plans. This includes warehousing and supply chain assessments done in Benin, Ghana, Ethiopia, Mali, Rwanda, and Senegal. RTT also conducted a training for district store managers in Zambia in September.

A sub-contract with Cultural Practice is being developed to conduct country assessments of gender practices and biases towards women participating in spray campaigns. The first three country assessments will be completed in March 2013.