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PMI | Africa IRS (AIRS) Project

Indoor Residual Spraying (IRS 2) Task Order Four

GHANA END OF SPRAY REPORT

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Abt Associates Inc. | 4550 Montgomery Avenue | Suite 800 North
Bethesda, Maryland 20814 | T. 301.347.5000 | F. 301.913.9061
www.abtassociates.com



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ACRONYMS

AIRS	Africa Indoor Residual Spraying
A&P	Anemia and Parasitemia
BCC	Behavior Change Communication
BMP	Best Management Practice
CBS	Community-based Surveillance
CDC	Centers for Disease Control and Prevention
CS	Concentrated Suspension
DA	District Assembly
DEV	Data Entry Verification form
DCV	Data Collection Verification form
EE	Error Eliminator form
EPA	Environmental Protection Agency
GHS	Ghana Health Service
GHI	Global Health Initiative
HLC	Human Landing Catch
IEC	Information, Education and Communication
IRS	Indoor Residual Spraying
KCCR	Kumasi Center for Collaborative Research
LLIN	Long-lasting Insecticide Net
M&E	Monitoring and Evaluation
MaVCOC	Malaria Vector Control Oversight Committee
MOH	Ministry of Health
NIRMOP	National Insecticide Resistance Monitoring Partnership
NMCP	National Malaria Control Program
NMIMR	Noguchi Memorial Institute for Medical Research
PMI	President's Malaria Initiative
PPE	Personal Protective Equipment
PSC	Pyrethrum Spray Catch
PSDQA	Post-Spray Data Quality Assessment
PSECA	Pre-Season Environmental Compliance Assessment

QA/QC	Quality Assurance/Quality Control
SOC	Spray Operations Coordinator
SOP	Spray Operator
TOT	Training of Trainers
USAID	United States Agency for International Development
USG	United States Government
WHO	World Health Organization

EXECUTIVE SUMMARY

The President's Malaria Initiative (PMI) has been funding indoor residual spraying (IRS) in Ghana since 2008 with the aim of reducing the malaria burden, especially among children less than five years old and pregnant women. In August 2011, Abt Associates was awarded a three-year Africa-wide IRS (AIRS) project, funded by the United States Agency for International Development (USAID) under PMI.

Ghana started spraying in five districts in 2008 and gradually scaled up to nine districts in 2011. In 2013, the number of IRS districts was decreased to four as a result of increased vector resistance to pyrethroids, necessitating the use of a significantly more expensive long-lasting organophosphate (Actellic CS). Behavior change communication (BCC) activities still continued in 2013 in the five previous IRS districts to ensure that residents continued to utilize other forms of malaria prevention, especially long-lasting insecticide treated nets (LLINs), in the absence of IRS.

Implementation of Ghana's IRS program was built upon lessons learned as the country entered its seventh year of spraying in 2014 with support from PMI. In 2014, AIRS Ghana continued to implement IRS in the same four districts as in 2013. In an effort to reduce costs and make IRS operations more efficient, the number of spray days was reduced from 45 days to 36 days. The 2014 IRS campaign started on April 14th and ended on May 31st. While the number of seasonal staff, such as spray operators, increased during the shorter spray period, the number of vehicles stayed the same and they were used more efficiently, by making multiple trips per day. Supervision levels for spray operators remained the same to assure high spray quality. This was accomplished by increasing the total number of supervisors to maintain the ratio of one supervisor for every five spray operators. Spray operator coverage reporting was monitored on a daily basis in order to closely track structures that needed additional visits.

Local temporary staff were recruited and trained for the 2014 spray operations well before the start of the campaign. Logistics and environmental compliance assessments were carried out to ensure that the standard operating procedures and Best Management Practices (BMP) were followed. Stakeholder, partner planning, and community sensitization meetings were also held in order to create the necessary awareness and effective involvement of all stakeholders for successful spray operations.

A total of 216,876 structures were targeted to be sprayed in four districts, Bunkpurugu Yunyoo, East Mamprusi, West Mamprusi and Savelugu Nanton, which had a targeted total population of 568,059. Spraying began on April 14th in all four districts and ended on May 17th in Bunkpurugu Yunyoo and spray operations ended on May 31st in West Mamprusi, East Mamprusi and Savelugu Nanton.

By the end of IRS operations, day 36 of the campaign, AIRS Ghana found 244,799 structures. A total of 205,230 structures were sprayed yielding a spray coverage of 83.8%. A total of 570,572 people were protected by IRS, including 12,538 pregnant women and 105,983 children under 5 years old.

AIRS Ghana experienced many challenges which contributed to the low spray coverage in three districts, East Mamprusi, West Mamprusi and Savelugu, but the team worked hard to ensure that coverage improved. AIRS Ghana worked closely with district and local Chiefs, Opinion Leaders, and Assembly Men and Women to tackle many of the challenges which were faced. The program also engaged more mobilizers and packers and collaborated effectively with the regional and district health directorates.

TABLE I. AIRS GHANA AT A GLANCE

Number of districts covered by PMI-supported IRS in 2014	4 districts: Bunkpurugu Yunyoo, East Mamprusi, Savelugu Nanton, West Mamprusi
Insecticide	Organophosphate (Actellic 300 CS)
Number of structures covered by PMI-supported IRS in 2014	205,230
Number of structures found by SOPs during 2014 PMI-supported IRS spray season	244,799
2014 spray coverage	83.8%
Population protected by PMI-supported IRS in 2014	570,572 (including 12,538 pregnant women and 105,983 children under 5 years old)
Dates of PMI-supported IRS campaign	April 14 to May 31, 2014
Length of campaign	36 days
Number of people trained with U.S. Government funds to deliver IRS ¹	Overall: 750

¹ Based on the PMI indicator definition. This includes only spray personnel such as SOPs, team leaders, supervisors, and clinicians. It excludes data clerks, Information, Education and Communication (IEC) mobilizers, drivers, washers, porters, pump technicians, and security guards.

I. INTRODUCTION

Malaria prevention and control is a major foreign assistance objective of the U.S. Government (USG). In May 2009, President Barack Obama announced the Global Health Initiative (GHI), a multi-year, comprehensive effort to reduce the burden of disease and promote healthy communities and families around the world. Through the GHI, the United States will help partner countries improve health outcomes, with a particular focus on improving the health of women, newborns, and children. PMI is a core component of the GHI. PMI was launched in June 2005 as a five-year, \$1.2 billion initiative to rapidly scale up malaria prevention and treatment interventions and reduce malaria-related mortality by 50 percent in 15 high-burden countries in sub-Saharan Africa. With passage of the 2008 Lantos-Hyde Act, funding for PMI has now been extended through fiscal year 2014. Ghana was identified as one of the African countries to benefit from PMI support in December 2006.

IRS is a major component of Ghana's current National Malaria Control (NMCP) Strategy, with the goal to protect one third of Ghana's districts with IRS by 2015. Ghana began implementing IRS with the support of PMI in 2008, by spraying five northern region districts (Tolon-Kumbungu, Savelugu Nanton, West Mamprusi, Gushegu, and Karaga), which covered approximately 601,000 people. The number of beneficiary districts was steadily scaled up to nine by adding four new districts (East Mamprusi, Saboba, Chereponi, and Bunkpurugu Yunyoo) by the close of 2011, covering up to approximately 941,240 people in 2012.

In 2014, Ghana targeted four districts in the Northern Region. A total of 216,876 structures were targeted to be sprayed. Spraying began on April 14th across all four districts and ended on May 17th in Bunkpurugu Yunyoo, while spray operations ended on May 31st in West Mamprusi, East Mamprusi and Savelugu Nanton.

At the end of the 2014 campaign, 244,799 structures were found and 205,230 structures were sprayed yielding spray coverage of 83.8%. A total of 570,572 people were protected by IRS, this includes 12,538 pregnant women and 105,983 children less than 5 years old.

Table 2 gives an overview of the number of districts sprayed each year and the population protected.

TABLE 2. NUMBER OF DISTRICTS AND POPULATION PROTECTED SINCE 2008

Year	Number of Districts	Population Protected
2008	5	601,000
2009	6	708,103
2010	8	849,620
2011	9	926,699
2012	9	941,240
2013	4	534,060
2014	4	570,572

The following objectives were achieved during 2014 IRS operations:

- Despite recording a very low IRS coverage in Savelugu Nanton, (68%) AIRS Ghana managed to meet the PMI target of 85% coverage in the other three districts. The Ghana IRS team continued to work in partnership with the Ghana Health Service (GHS) and NMCP to plan and implement IRS operations in the targeted districts. The Ghana IRS team provided technical support to local staff and community members for implementation of IRS operations. This support includes conducting training for seasonal spray staff, such as SOPs, community-based surveillance (CBS) volunteers, district data managers, etc.
- AIRS implemented improved monitoring, supervision, and verification procedures for community coverage reporting. As a result spray operators found 13% (27,923) more structures in 2014 than originally targeted. In addition, the accuracy of coverage rates was improved.
- The Ghana IRS team provided financial and technical support for entomological monitoring with the support of Noguchi Memorial Institute for Medical Research (NMIMR). This included monthly entomological evaluations which were conducted by trained field technicians under the direct supervision of the AIRS Entomologist, and they included insecticide resistance evaluation. The Noguchi team provided quarterly technical oversight and performed advanced molecular evaluations. The entomologic monitoring program also generated critical data on the effectiveness of the spray program and potency of the insecticide which was used for vector control.
- The program also continued to provide financial and technical support to the National Malaria Vector Control Oversight Committee (MaVCOC).

2. PRE-SPRAY ACTIVITIES

2.1 INSECTICIDE SELECTION

As in 2013, the AIRS Ghana team, NMIMR, PMI, GHS, NMCP, and the MaVCOC analyzed all entomological data and based on the evidence, decided that a long-lasting organophosphate, Actellic CS, would be most effective and appropriate for IRS use in the 2014 spray round. This decision was based largely on the susceptibility of the local vectors and residual effect (see section 6 of this document for susceptibility results).

2.2 MICRO-PLANNING

To effectively plan for a successful IRS campaign, the AIRS team conducted micro-planning meetings just before the start of the spray season, in February 2014, to prepare. A regional meeting was held with the Ghana Health directorate, Environmental Protection Agency (EPA) and regional NMCP. The purpose of the meeting was to review the operational plan and target for the 2014 operations and also renew stakeholder roles and commitments. Planning meetings were also held with stakeholders at the district and community levels. The district Assemblies, the District Health Management Teams, traditional rulers and opinion and women leaders were key to the success of these meetings. In all, one regional and four district planning meetings were held. The following agenda items were discussed:

- Spray campaign length
- IEC plans and strategies
- Insecticide selection
- International and local procurement
- Performance and target setting
- Monitoring and supervision plan
- Recruitment of SOPs
- Commencement date for spray operations
- Partner roles and commitments
- Sanctions and disciplinary standards for spray teams during spray exercise if there is misconduct especially regarding data reporting
- Spray coverage targets and data quality

Particular attention was put on the caliber of spray operators to be recruited to ensure high quality spraying and honest data reporting.

2.3 LOGISTICAL NEEDS ASSESSMENT

The purpose of the logistical needs assessment was to carry out a systematic inventory of requirements for the implementation of a cost-effective and efficient IRS campaign in 2014. AIRS Ghana organized a team that provided technical support to the districts during the assessments for 2014 season. The process involved discussions with the District Chief Executive Officers who are the political heads in the districts and district health officials (the Director and his/her team).

The following activities were carried out:

- Held meetings with the district health office teams and the officials from district assemblies to discuss district readiness for the campaign
- Reviewed previous coverage and agreed on targets
- Shared activities, and associated costs, to be implemented in the 2014 at the district level with DHMT teams
- Assisted districts to strategize how to identify potential partners and engage all stakeholders in IRS activities
- Quantified IRS commodities required for 2014 spray season

The results from the assessment were used for international and local procurements.

2.4 PROCUREMENT

Procurement for commodities to be used in the 2014 IRS campaign was divided into two- international and local procurements. All items that were available in Ghana were procured locally which ensured cost effectiveness and the timely delivery of the commodities.

A total of 8,267 bottles of Actellic CS remained after the end of the 2013 IRS campaign. Since the 2014 target was to spray 216,876 structures, it was calculated that Ghana AIRS needed 48,686 bottles of organophosphate in total (including a 10% cushion). Taking into consideration the old stock of 8,267 bottles of Actellic CS, Ghana AIRS needed to procure only 40,419 bottles (this was equal to 3,368.25 boxes given that there are 12 bottles in each box). Since AIRS needed to procure boxes, as opposed to individual bottles, 3,369 boxes were procured, which totaled 40,428 bottles.

Apart from the insecticides, other international consignments included Goizper pumps, nose masks, hard hats and face shields which were received in Tamale on April 9, 2014. The rest of the items procured were local procurements. For details of the materials procured internationally and locally and stock quantities, see Annex A.

2.5 HR REQUIREMENTS

The district human resource requirements consisted of two groups: (1) district core staff (Spray Operations Coordinators (SOCs), Monitoring and Evaluation (M&E) Coordinators, Information, Education and Communication (IEC) Assistants, Data Assistants, Logistics Assistants) and (2) support staff (Site Managers, Field Supervisors, Team Leaders, SOPs, Store Assistants, Washers, Water Fetchers and Security Officers). In addition, some Ghana Health Service Implementers, community-based volunteers and individuals who could read and write were engaged by AIRS Ghana to carry out house-to-house mobilization activities. Additional human resources were engaged to carry out entomological activities. These included mosquito collectors and supervisors.

2.5.1 TYPES OF TRAININGS AND NUMBER OF PEOPLE TRAINED

IRS is a highly technical process and demands vigorous and thorough training of all personnel involved in order to achieve the intended impact. To ensure a successful IRS program there is a need to have well trained spray operators and other staff involved in the IRS campaign. Training of spray operators is done by the AIRS district staff and it is conducted annually before the commencement of spray operations. These trainings are meant to provide specific skills to personnel involved in the IRS campaign so that they are able to spray structures correctly. In all, 10 different trainings were organized to ensure that all staff was prepared for the 2014 spray campaign.

According to the gender assessment performed by Cultural Practice, it was noted that there was poor participation of women in the IRS program in Ghana. The report made the following recommendations:

1. Expand recruiting efforts for women. This includes arranging for previous spray round female staff to talk to females in targeted communities. Advertisement should be revised to include photos of local women who were employed in previous campaigns
2. Revise aspects of the training. This includes Revising the militaristic language used in the training which is off-putting and discourages many women from even applying. Also, changing sequencing and/or length of some training sessions to allow for more gradual strength building and more repetition on critical skills, such as data recording
3. It was also recommended to improve the sizing and type of the uniform
4. Increase the number of lighter-weight, double-shouldered tanks available for use in spraying.

Prior to the 2014 IRS operations, AIRS Ghana actively implemented the recommendations in the gender assessment report. The following was specifically done:

1. A team, made up of females recruited in previous spray campaigns (Store Assistants, Supervisors, Team Leaders, Spray Operators, Washers and Water Fetchers) was led by the IRS IEC Coordinator to encourage other females to participate in IRS activities. They visited churches and mosques and attended community meetings to advocate for more female participation in IRS activities.
2. Interactive radio programs were held to emphasize the need for more females to participate in IRS activities. Also, radio announcements were made about upcoming vacancies and females were strongly encouraged to apply.

After this process, AIRS Ghana recorded an increase in the number of women who were trained by the program to deliver IRS. In 2013, 146 females were trained to deliver IRS, which represented 22% of the total number of people trained to deliver IRS (669). In 2014, 207 females were trained to deliver IRS which represents 28% of the total number of people trained to deliver IRS (750). This shows an increase of 27% (22% to 28%). The program is very confident that in the next spray campaign the number will improve further.

Table 3 describes the type of trainings conducted, their timing, venue, and a brief description. Overall, a total of 1,657 people were trained to carry out different roles. Out of this, 1,357 were males and the remaining 300 were females. The percentage of females trained increased from 13.9% in 2013 to 18.3% in 2014. The proportion of females trained to deliver IRS is much higher than the overall proportion of

females women trained because there was an effort to encourage more females to be involved in spray activities. In the future, similar efforts will be put in place to encourage more females to be involved in IRS supporting roles such as mobilizers. Details of the number of people trained for the various IRS duties are provided in Table 4.

TABLE 3. TYPES OF TRAINING, DURATION, VENUE AND BRIEF DESCRIPTION OF TRAININGS

Type of Training	From	To	Venue	Brief Description
Mobilizers Training	18/03/14	22/03/14	In all sub-districts	Training was focused on AIRS IEC strategy. Participants were to go back to their communities to sensitize and mobilize households ahead of the 2014 spray campaign.
IEC Training of Trainers (TOT)	10/03/14	12/03/14	Tamale	Training on IEC and mobilization strategies, which include sensitization techniques, structure identification and household mobilization data collection. Participants were trained to offer training to mobilizers at the district level.
Logistics and Store Management	10/03/14	12/03/14	Tamale	Record and stock keeping of all inventories.
Training of Trainers: Spray Ops	24/03/13	29/03/13	Walawale	Training on spraying techniques, compliance and data capture.
Training for SOPs	07/04/14	12/04/14	All 4 districts	Training on spraying techniques and compliance and data capture
AIRS Database taining	24/03/14	26/03/14	Tamale	Introduction to and use of the 2014 AIRS database for mobilization and spray data entry. Participants were also trained on the data cleaning system, data storage and security systems.
Health Worker/Poison Management	1/03/14	1/03/14	Tamale	Managing insecticide poisoning at the health facility.
Fire/ Security Training	14/03/14	17/03/14	Tamale	Handling fire at the operational site and basic security best management practices at the operational site.
Drivers training	12/04/14	12/04/14	Tamale	Defensive driving techniques, safe driving while driving a vehicle with insecticides
Applied entomology Training (Part of capacity building for NMCP)	24/08/14	29/08/14	Tamale	Build in-country capacity needed for the execution of an effective entomological surveillance program and also promote better understanding of the IRS program

TABLE 4. NUMBER OF PEOPLE TRAINED

Categories of Persons Trained	Training on IRS Delivery										Other Trainings										Total		
	Training of Trainers: Spray Ops		Spray Operations		Data Entry		Logistics & Store management		IEC Training of Trainers (TOT)		IEC Mobilisers Training		Medical Treatment Intoxication Training		Fire/ Security Training		Driver's Training		Applied Entomology Training				
	M	F	M	F	M	F	M	F	M	F	M	F	M	F	M	F	M	F	M	F	M	F	TOTAL
SOC	5	0	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	5	0	5
Disease Control Officers	5	0	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	5	0	5
District Environmental health officers	4	0	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	4	0	4
District Health Information Officer	1	0	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1	0	1
Spray operators	-	-	428	178	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	428	178	606
Data Assistants	-	-	-	-	13	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	13	1	14
District M & E Coordinators	-	-	-	-	5	1	-	-	-	-	-	-	-	-	2	0	-	-	-	-	5	1	6
Entomological Technician	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1	-	1	0	1
Laboratory Technician	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1	-	1	0	1
Malaria Focal Person	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	6	3	6	3	9
Biomedical Scientist	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1	-	1	0	1
Biologist	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1	-	1	0	1
Disease Control Officers (Non-IRS districts)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	4	-	4	0	4
Surveillance Officer	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1	-	1	0	1
Logistics	-	-	-	-	-	-	5	0	-	-	-	-	-	-	-	-	-	-	-	-	5	0	5

2.5.2 NUMBER OF PEOPLE HIRED

A total of 1,525 temporary staff was hired to deliver services during the 2014 IRS campaign. Of these, 320 were female and 1,205 were males. The percentage of females hired increased by from 13.8% in 2013 to 21.0% in 2014. The temporary staff hired includes 425 SOPs of which 125 (29.4 percent) were females.

The number of females hired for the role of SOP in 2014 increased to 125 compared to 40 in 2013. In 2013 the percentage of female SOPs hired was 14% while in 2014 the percentage of female SOPs hired was 29%; a 110% increase.³

In addition to the numbers provided in the table, a total of 1,495 CBS Volunteers⁴ from the various communities were engaged for one or two days (depending on the number of days a volunteer's community was sprayed) to help with community announcements in the evening before the day of spray and on the actual day of spray. Note that CBS Volunteers took part in stakeholder meetings at the sub-district level and through these meetings they were equipped with information about IRS and about their mobilization roles⁵.

TABLE 5. NUMBER AND TYPE OF PEOPLE TEMPORARILY HIRED

Category	Bunkpurugu Yunyoo		East Mamprusi		Savelugu Nanton		West Mamprusi		All		
	F	M	F	M	F	M	F	M	F	M	Total
Data Assistants	0	3	1	2	1	2	0	3	2	10	12
Finance Assistants	0	1	1	0	0	1	0	1	1	3	4
IEC Assistants	0	1	1	0	0	1	0	2	1	4	5
Logistics Assistants	0	1	0	1	0	1	0	1	0	4	4
Store Assistants	4	1	3	0	3	0	4	1	14	2	16
Mobilizers	20	198	26	164	5	210	36	144	87	716	803
Pump Mechanics	0	0	0	0	0	0	0	0	0	0	0
Security officers	0	10	0	6	0	6	0	10	0	32	32
Site Managers	0	5	0	3	0	3	0	5	0	16	16
Spray Operators	64	26	28	82	10	80	23	112	125	300	425
Supervisors	0	9	2	9	0	8	2	13	4	39	43
Team Leaders	7	2	3	19	0	18	1	26	11	65	76
Washers	12	1	10	0	7	1	19	0	48	2	50
Water Fetchers	4	0	5	1	3	3	14	4	26	8	34
M&E Coordinators	0	1	0	1	1	0	0	2	1	4	5
Total	111	259	80	288	30	334	99	324	320	1,205	1,525

³ In 2013, 40 (13.8 percent) of the 290 SOPs hired were females.

⁴ Ideally, there are supposed to be two volunteers in each community; however, in the 789 communities in four targeted IRS districts this was not always the case and thus several communities only had 1 CBS Volunteer.

⁵ CBS Volunteers did not receive formal IEC training nor were they hired by the project; therefore, they are not captured in Tables 5 and 6.

3. INFORMATION, EDUCATION AND

3.1 INTRODUCTION

The IEC component of the IRS program performs a major role in creating awareness and adequately mobilizing community members for spraying. Several strategies were employed to ensure successful operations. Some of these strategies included: stakeholder meetings, community level meetings, in-school programs, house-to-house mobilization, radio discussions and video shows. The engagement of beneficiaries, stakeholders and partners ensured open discussions that reached many people of different target groups and was aimed at improving acceptance. It is important to note that the IEC strategy was heavily strengthened in the fourth week of the IRS campaign when it was noted that the coverage was low in all the districts except Bunkpurugu Yunyoo where the coverage was high.

3.2 PRE –SPRAY STAKEHOLDER MEETINGS

Pre-spray stakeholder meetings were held from April 1 to April 13, 2014 in all of the target districts. The main purpose of these meetings was to harness ideas and get feedback from beneficiaries and stakeholders to enhance IRS activities. The stakeholders included community leaders, Chiefs, women leaders, representatives from the District Health Office, and representatives from the DA. To show commitment and support for IRS, two of the stakeholder meetings were held at the palaces of the Yoo Naa (Chief of Savelugu Nanton district) and Wungu Rana (Chief of West Mamprusi). The meetings were also an opportunity to highlight the role of district authorities and community leaders in the provision of infrastructure and office space for IRS activities. A total of 16 pre-spray stakeholder meetings were organized in the four operational districts. An additional stakeholder meeting was held during the official launch of the 2014 spray campaign in West Mamprusi district and the Guest of Honor was Dr. Philip Ricks, the Ghana Resident PMI/CDC Advisor.

3.3 COMMUNITY MEETINGS

As the spray period progressed, community meetings were carried out in targeted communities and compounds that were showing signs of low acceptance. These meetings were aimed at sensitizing the communities and targeting landlords to understand the systems and processes of the IRS program, its benefits, as well as the need to meet Ghana's 90% community coverage target. District health staff, district assembly personnel, chiefs and other community leaders played a leading role in mobilizing, sensitizing and adequately preparing communities ahead of spray teams, before and during the spray exercise. See Table 6 for the number of meetings and attendance in each of the four districts.

TABLE 6. NUMBER OF COMMUNITY MEETINGS HELD AND NUMBER OF PEOPLE ATTENDED

District	# of meetings	Dates	Total number of people in attendance
Bunkpurugu-Yunyoo	25	April - May	1,518
East Mamprusi	32	April - May	1,291

West Mamprusi	28	April - May	291
Savelugu-Nanton	147	April - May	3,822
TOTAL	232		6,922

3.4 RADIO PROGRAMS⁶ AND VIDEO SHOWS

There were three main radio programming initiatives used in the 2014 IRS campaign: radio spots which are also called jingles, radio discussions (interactive shows) and announcements about IRS and its benefits. Radio spots started airing on April 2, 2014, two weeks before the start of spray operations and continued three times per day throughout the spray period. Discussions were centered on achieving the NMCP target of 90% per community (coverage) and addressing other community concerns about spray activities. It also included messages about household preparation, safety, and compliance. These radio programs were conveyed in the local language to ensure the full understanding of community members and the general public. Monitoring of radio spots in terms of timing and adequate slots was successfully carried out by the IEC team at the community, district and regional levels.

In communities where it became necessary, video shows were organized to intensify the education of community members. The videos included the following topics: malaria prevention (a video produced by Hudson X- Pert sprayer), malaria cycle, and video/pictures of community engagements. Video shows were usually held in the evening.

Table 7 shows the number of radio programs and videos shows.

TABLE 7. NUMBER OF IRS RADIO PROGRAMS, VIDEO SHOWS AND IEC MATERIALS DISTRIBUTED

Activity	Total number
Radio spots; jingles (before, during, and after spray)	360
Radio programs (interactive shows)	20
Radio Announcements	300
Video shows	46
IRS materials distributed (to public places)	9,080 ⁷

3.5 HOUSE TO HOUSE MOBILIZATION/ SENSITIZATION

House-to-house mobilization commenced on March 25, 2014 ahead of the start of the 2014 spray campaign. The program trained and engaged a total of 803 mobilizers who were residents in the targeted communities. This enabled them to visit every compound with IRS messages. The face-to-face interaction with households demystified and corrected any misconceptions about IRS and further educated households on their roles and responsibilities before, during, and after spray activities. The mobilizers also ensured that the community members were informed of spray dates for their

⁶ Bunkpurugu Yunyoo and East Mamprusi do not have any radio stations. West Mamprusi and Savelugu Nanton have radio stations that cover all the communities around their operational sites. The radio station in West Mamprusi also covers all of the communities in the operational sites in East Mamprusi.

⁷ This refers to the number of IEC materials that were pasted in public places like schools and market places. It does not include the number of IEC materials that were given to the households during the house-to-house mobilization activity. The quantity given directly to households is presented in Table 10.

communities. During the house-to-house mobilization, mobilizers also collected household data on the number of people reached with IRS messages, provided each household with an IRS card and placed a sticker⁸ on the wall to give a unique identity to the compounds. This data also helped provide an enumeration of the number of compounds in a community and was used to track and verify the number of compounds visited.

FIGURE 1: IRS STICKER ON WALL WITH CORRESPONDING SERIAL NUMBER ON IRS CARD



⁸ The sticker was used to mark the house with their unique ID that matches their IRS card. In this way, even when the IRS card is missing or the card holder/ bearer is not available on the day of spraying, the unique ID is available. Additionally, SOPs were instructed to write their SOP code and if sprayed, the spray date in chalk or marker near the posted sticker. This provided supervisors with a quick visual marker of spray coverage in the field.

Though the house-to-house mobilization was originally scheduled to take place in six days, delays in the delivery of some logistics items delayed the completion. As a result, house-to-house mobilization was scheduled for communities by order of spray with those communities being sprayed first, mobilized first. During the spray campaign, house-to-house mobilization continued with households being visited by mobilizers prior to spray.

TABLE 8. HOUSE-TO-HOUSE MOBILIZATION RESULTS

District	Number of Households Visited	Number of Households Sensitized ⁹	# Adults Reached with IRS Messages			Number of Households Accepting IRS	% of Households who said they would accept IRS ¹⁰	# of IEC/BCC Materials Distributed ¹¹
			Males	Females	Total			
Bunkpurugu-Yunyoo	13,611	13,597	24,476	28,515	52,991	13,597	99.90%	2,714
East Mamprusi	13,590	13,590	25,889	30,633	56,522	13,584	99.96%	7,957
Savelugu-Nanton	11,109	11,088	18,939	25,396	44,335	11,017	99.17%	6,343
West Mamprusi	13,957	13,950	24,891	29,288	54,179	13,924	99.76%	3,306
TOTAL	52,267	52,225	94,195	113,832	208,027	52,122	99.72%	20,320

3.6 JOINT IEC/BCC ACTIVITIES WITH DISTRICT DIRECTORATES

As of the third week of the 2014 spray campaign, all districts apart from Bunkpurugu Yunyoo had a spray coverage that was below the expected percentage at the time of spray. This was especially the case in Savelugu Nanton District. Approximately 59% of unsprayed structures were not sprayed because they were locked. Close to 27% of unsprayed structures were not sprayed because the owners refused to allow spraying to be done in their structures. A common reason for refusal was that household members did not like the smell of the insecticide. Others also expressed concerns about packing out their items. A combined 10.97% of unsprayed structures were not sprayed because there were sick persons in the structure, there was a funeral taking place in the compound or there was no one at home at the time of the visit by the Spray Operator. Also, approximately 3% of unsprayed structures was caused by other reasons. Common among the “other” reasons cited by households was that their rooms were undergoing plastering at the time of the Spray Operators’ visit.

The following strategies were put in place to help improve spray coverage:

- Reports were generated for communities and compounds with low coverage (coverage less than 90%). The reports were used by district teams to develop revisit plans and follow-up on specific compounds to ensure that revisits were effective.
- In Savelugu Nanton, staff from the District Health Management Team (DHMT) and the District

⁹ During house-to-house mobilization, sensitization took place per household/compound rather than by structure.

¹⁰ This is the percentage of households indicating to mobilizers that they would be willing to accept IRS during the spray campaign.

¹¹ This represents the number of posters/ brochures given directly to households during the house-to-house mobilization exercise. These materials explain the benefits of IRS and the preparations that households must undertake to receive treatment, e.g., packing out their items, etc.

Assembly was engaged to support sensitization of households on the importance of IRS.

- In West Mamprusi, the Disease Control Office worked with the district team to ensure that all strategies put in place to strengthen IEC for revisits were implemented.

At the regional level, AIRS held a high level meeting with the Regional Director of Health and all District Health Directors for the four districts were present. Issues concerning the low coverage in districts were discussed and it was concluded that there was need to strengthen collaboration with all stakeholders and intensify IEC/BCC activities at the district and community level. High level stakeholder meetings were also held in three low coverage districts. At the stakeholder meetings, it was agreed upon that a series of IEC activities were to be carried out at the district and community level. The following activities were carried out in the districts:

- Extra door-to door mobilization and community announcements utilizing a public address system in advance of SOP visits. This was carried out mostly the night before the SOP visits.
- Community meetings with Opinion Leaders and Chiefs in communities with low coverage. In some communities, the chief took interest and requested information on compounds with low coverage in order to send his representative to those compounds to convince them to spray.
- Radio advertisements and radio show discussions that emphasized the benefits of IRS.
- Video presentations on the malaria cycle, the deadly nature of malaria, and the need to prevent it.
- Hiring of packers to help households to pack out their items, especially in compounds where households found it difficult to pack out their items all by themselves.
- Early or late day spraying, especially in communities where most households were involved in intensive farming activities.
- Use of District/Community Public Health Officials for community outreach programs.
- Door-to-door sensitization prior to revisits by community-based volunteers.
- Community meetings prior to revisits. Once a date was fixed for a community to be revisited, a community meeting was held to agree on the date and address any concerns that households may have.
- Revisits were carefully planned using the report on communities and compounds with low coverage. These reports were generated from the AIRS database and it was used to guide revisits.

Spray operations were halted across all districts from May 19-24, 2014. The purpose of the halt was to have ample time to implement the above mentioned activities in the three districts with low coverage.

4. IMPLEMENTATION OF IRS ACTIVITIES

4.1 INTRODUCTION

Spray operations started simultaneously in all the 16 operational areas across the four IRS districts. Spraying began on April 14, 2014 and ended on May 31, 2014. Initially the IRS campaign was scheduled to last 30 days in 2014. By planning for a 30 day spray campaign, a total of \$262,620 was envisioned to be saved by this reduction in the number of days (15 days less in Bunkpurugu Yunyoo and nine days less in Savelugu and East and West Mamprusi). Since the coverage was very low in three districts (East Mamprusi, Savelugu and West Mamprusi districts), the campaign was halted in affected districts from May 19- 24, 2014. The purpose of the stoppage was to engage the district health directorates to embark on intensive IEC activities, including stakeholder meetings with Chiefs, Opinion Leaders and community members to address issues concerning low coverage in the communities. The stoppage was also an opportunity for districts to revisit sprayed communities to ensure that compounds had not been missed. Spray operations resumed on May 26, 2014 and ended on Saturday 31st May, 2014. Though the spray campaign in Bunkpurugu Yunyoo ended on May 17, 2014, some missed compounds were identified during the stoppage period in spray operations. These missed compounds were sprayed between May 26-31, 2014.

A total of 216,876 structures were targeted to be sprayed. At the end of the campaign, 244,799¹² structures had been found and 205,230 structures were sprayed. There was an outbreak of tribal violence in some parts of East Mamprusi district. As a result, Shisha community under Sakogu sub district was not sprayed. At the time of mobilization and spraying, the community had been burnt down and residents had fled the community. Table 9 shows the targets for each of the districts, structures found and sprayed, and the coverage. It also shows the number of spray days for each district.

Table 9. Number of Structure Sprayed in the Four Districts

District	Targeted # Structures (Based on Structures Found by SOPs in 2013)	Structures Found by SOPs	Structures Sprayed	Spray coverage	Targeted Population (Based on Structures Found by SOPs in 2013)	Pop. Protected	# of Spray Days
Bunkpurugu Yunyoo	46,131	53,269	49,370	92.7%	109,778	120,755	30
East Mamprusi	56,387	66,725	58,245	87.3%	154,230	167,401	35
Savelugu Nanton	45,036	49,408	33,573	68.0%	120,601	97,775	35
West Mamprusi	69,322	75,397	64,042	84.9%	183,450	184,641	35
Total	216,876	244,799	205,230	83.8%	568,059	570,572	

¹² This figure includes estimates for the number of structures found/unsprayed in un-accessed compounds. Every compound in a community that is not accessed is assigned a number of structures that is equivalent to the average number of structures per compound in that community based on the 2013 spray data.

4.2 MONITORING & SUPERVISION

Indoor residual spraying is a highly technical process that demands thorough supervision and monitoring in order to achieve the intended impact. Consistent with the AIRS theme for 2014, ‘trust but verify’, the Ghana AIRS team ensured that there was adequate monitoring and supervision at all levels throughout the different stages of the spray campaign (before, during and after). At the national level, the Chief of Party, Operations Manager, M&E Manager, Database Manager, IEC Specialist, and the Environmental Compliance Officer formed one supervision team. The district teams were comprised of the Spray Operations Coordinator, the District M&E Coordinator, and the District Logistics Officer, while at the site level the supervisory team was comprised of the Site Manager, Field Supervisors and Team Leaders.

In order to improve supervision, all teams used standardized AIRS supervision and monitoring tools to assess the spray quality, environmental compliance activities and spray data collection. These tools are described further in Table 10.

Based on lessons learned from the 2013 PSDQA, improved monitoring and supervision included comparing the number of mobilized compounds with sprayed compounds to ensure that missed compounds are identified and captured. This was done by supervisors at the end of the day. The list of sprayed compounds was compared to the list of compounds that were mobilized in that particular community.

A monitoring and supervision schedule was developed and used during the 2014 spray campaign. The schedule showed the role of specific individuals, which site they were working from, the type of supervisory tools to be used and the frequency of the usage of each supervisory tool. The schedule captured the Chief of Party, Operations Manager, M&E Manager, Database Manager, IEC Coordinator, all SOCs, Field Supervisors and Site Managers. It was through this intensified supervision, that misreporting of data by 12 spray operators in Savelugu Nanton was detected and as a result their contracts were terminated. This was discovered during the spray campaign, when the M&E team was reviewing spray data and found some entries that were suspicious. The coverage reported by a few spray operators was much higher than normal. After intense investigations, it was found that 12 spray operators were involved with data falsification and so they were fired on May 26th, 2014. In addition, two team leaders and two supervisors received a one week pay cut because they did not adequately supervise the 12 spray operators who were found falsifying data. **Table 10. 2014 Spray Campaign Supervisory Tools** provides description on the supervisory tools that were used for the 2014 spray campaign.

Table 10. 2014 Spray Campaign Supervisory Tools

Supervisory tool	Used by who and when
Morning Mobilization and Transport	<p><i>Purpose:</i> To ensure Spray Teams leave for the day with the correctly accounted for PPE, equipment, insecticide, and supplies, and they are safely transported to the spray site.</p> <p><i>Person responsible for completing this checklist:</i> Site Manager, Field Supervisor, Environmental Compliance Officer, Spray Operations Coordinator.</p>
End-of-Day Clean-Up	<p><i>Purpose:</i> To ensure Spray Teams follow correct EC procedures for cleaning equipment, accounting for insecticide stocks, and storing equipment for the next day.</p> <p><i>Person responsible for completing this checklist:</i> Site Manager, Environmental</p>

	Compliance Officer, visiting HQ staff and SOCs (when visiting an operational site)
Home Owner Preparation and SOP Performance Checklist	<p><i>Purpose:</i> To ensure that Spray Operators are spraying houses (structures) that have been correctly prepared for spraying (inside and out) and that they are using correct spray and insecticide handling techniques.</p> <p><i>Person responsible for completing this checklist:</i> Spray Field Supervisors, IEC/ BCC Coordinator, Environmental Compliance Officer, Operations Manager and SOCs (when visiting the field for supervision)</p>
Storekeeper Performance Checklist:	<p><i>Purpose:</i> To ensure that Site Storekeepers are following best warehousing practices and accounting for stocks and equipment.</p> <p><i>Person responsible for completing this checklist:</i> A) The Site Manager, District Spray Operations Coordinator, District Logistics Assistant, Logistics Coordinator. Operations Manager, Chief of Party, visiting HQ staff.</p>

4.3 DATA REPORTING

Spray data was collected and entered into the AIRS database on a daily basis. SOPs collected the data while Team Leaders checked and verified data cards. Further checks were completed by the Field Supervisors, District M&E Coordinators, and Data Assistants before the data was entered into the database. Weekly IRS Progress Reports were shared with Abt Home Office and PMI.

4.4 LOGISTICS AND STOCK MANAGEMENT

In line with operational standards, AIRS Ghana trained and hired five District Logistics Assistants and 16 Site Store Assistants to manage district and site warehouses respectively. Records were monitored and updated using stock cards for each item with details of transactions, quantities involved, dates and destination. Regular physical stock counts were conducted by store managers to ensure that the actual stock corresponded with records on stock cards.

A weekly inventory was completed by the District Logistic Assistants for each operational site in their districts, and the balance of the inventory was reconciled with the inventory balances at each district warehouse. This was used as a basis to approve requests for IRS materials and also reconcile central warehouse stock in Tamale with district stock. To ensure that goods were tracked, signed copies of requests and delivery notes accompanied each transaction. The program also ensured that requisition notes were issued by the requestor and delivery notes issued in return as proof of delivery.

Insecticide trackers were used each morning to record the quantities of Actellic bottles received by each Team Leader. At the close of each spray day, Store Assistants recorded the number of full bottles returned and empty bottles returned onto the tracker, and thereafter transferred the data onto the stock cards, and the corresponding adjustments were made to match the physical stock.

5. POST-SPRAY ACTIVITIES

5.1 POST-SPRAY EVALUATION MEETINGS

At the end of the spray activities, post-spray stakeholders meetings which also served as the close out meetings, were held in all 4 district capitals of the operational districts. An average of 250 participants per district attended the post-spray evaluation meetings. The meetings were used as a platform for the AIRS Ghana program to share the 2014 spray results, share best practices and discuss the way forward in the next phase of the contract. It was also an opportunity to show appreciation to all stakeholders and beneficiaries for their support. In all of these meetings, it was very clear that all stakeholders and beneficiaries appreciated PMI and the USG's support for the various malaria control interventions in the districts and they hoped to witness a continual and scale up of the IRS program.

The following were some recommendations by the stakeholders:

- There should be greater collaboration and coordination during the planning stages between the IRS team and other decentralized departments of government to ensure that IRS activities do not conflict with other important national activities. This will make it possible for GHS and other decentralized departments to be involved in supervision.
- The IEC team should review and strengthen its package of messages to ensure that there are no misconceptions about IRS. Some community members believe that spraying sometimes introduces more mosquitoes in to the house. This has to be clarified by explaining why mosquitoes are visible in houses after spraying. Some households also insisted on spraying all rooms including the bathrooms and kitchens. It needs to be explained in the IEC materials why bathrooms and other non-sleeping rooms should not be sprayed.
- IEC activities should be intensified to reach more women. It was agreed that more women's groups should be involved in the dissemination of IEC/BCC messages. Men should also be encouraged to effectively participate in the preparation of households for spray operations.

A national post-spray evaluation meeting will be held in Tamale on August 7, 2014. Participants will include NMCP, AngloGold Ashanti, Regional Health Directorate, District Health Directorate and Environmental Protection Agency (EPA). The objectives of this meeting will be to:

- Present the performance of 2014 spray operations to stakeholders
- Share best practices and challenges from the 2014 IRS campaign

6. ENTOMOLOGY

Entomological monitoring component of the AIRS program in Ghana forms a critical component of the IRS program. It has been key to monitoring changes in vector indoor resting density, biting rate, rates of infection, susceptibility of vectors to different insecticides, evaluating the residual efficacy of sprayed insecticides on different types of treated surfaces; and most importantly used for decision making process for the change of insecticides from pyrethroids to an organophosphate during the last spray campaigns.

This report is a summary of activities conducted between January and June 2014. The AIRS entomology team worked closely with Ghana Health Services and District Assemblies to implement all planned field activities. AIRS Ghana also partnered with the Noguchi Memorial Institute for Medical Research to provide technical support in advanced molecular evaluations and quality assurance for the entomological activities.

Activities conducted during the period (January to June 2014) included;

- Cone bioassay tests for quality assurance of the IRS program & residual efficacy of the sprayed Actellic 300 CS formulation of pirimiphos methyl (an organophosphate);
- Identification of species of malaria vectors in targeted districts;
- Vector density, behavior and seasonality; and
- Vector susceptibility to insecticides.

6.1 CONE BIOASSAY TESTS FOR QUALITY ASSURANCE OF THE IRS PROGRAM & RESIDUAL EFFICACY OF THE SPRAYED ACTELIC 300CS

6.1.1 QUALITY ASSURANCE OF THE IRS PROGRAM

Spray quality assurance testing was conducted as per PMI guidance to provide important real-time feedback on the quality of spraying to the operations team and to major stakeholders. The communities where the quality assurance tests were conducted were:

- Tarikpaa and Nanton in the Savelugu-Nanton District
- Bunbuna in the Bunkpurugu-Yunyoo District
- Gbangu in the East Mamprusi District

To remove bias arising from spray operator efficiency, houses sprayed by different spray operators were chosen for the test.

In each community four houses (2 with cement wall surfaces and 2 with mud wall surfaces) were selected for the assessment of the quality of spray on the different surface types (cement, mud, wood) encountered in the community. Since most of the walls of the residential houses in the IRS operational districts are made of either cement or mud, cone bioassays were conducted on wooden doors or windows of each room selected to obtain information about the performance of sprayed insecticide on wood surface. In each room 3 walls of the room were tested, by fixing the cones at about 1.5m high on

each wall. Three (3) cone assays were carried out in any one house together with 1 assay on the wooden door or window using 10 adult female *An. gambiae* s.l. mosquitoes (2-5 day old) per cone.

One control cone assay was done for every 4 bio-assay tests, by fastening cardboard on unsprayed surfaces and exposing the control mosquitoes to the cardboard. To avoid the possibility of the control mortality increasing due to the airborne effect of the Actellic 300CS formulations, the control tests were setup in unsprayed structures with fairly similar conditions (relative humidity and temperature) as the rooms that were sprayed.

Bioassays in Tarikpaa Nanton and Bunbuna were conducted using both laboratory raised Kisumu strain and wild collected female adults of *An. gambiae* s.l. of about 2-5 days old. However the wall bioassays in Gbangu were carried out with only the laboratory raised Kisumu strain of *An. gambiae* s.l, due to the difficulty in getting enough wild *An. gambiae* s.l. populations in the area within the period the tests were conducted.

6.1.2 RESIDUAL EFFICACY OF ACTELIC 300CS

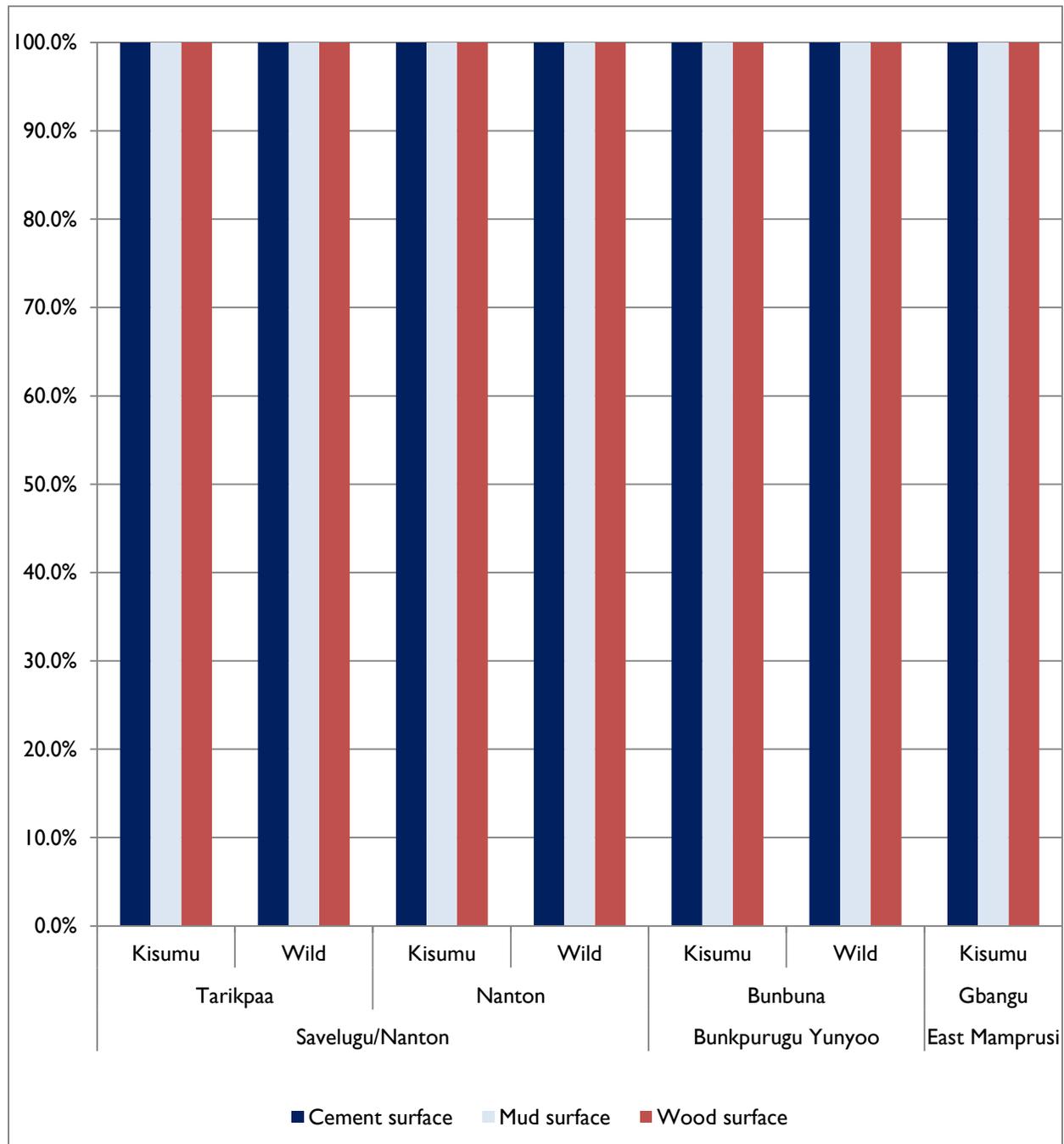
The residual efficacy testing using the WHO cone wall bioassay in selected sentinel sites was conducted using susceptible 'Kisumu' colonies from the AIRS insectary and the insectary of the Navrongo Health Research Center as well as wild *An. gambiae* collected from these communities. The communities tested included:

- Tarikpaa and Nanton in Savelugu-Nanton District
- Bunbuna and Yunyoo in Bunkpurugu-Yunyoo District

6.1.3 RESULTS

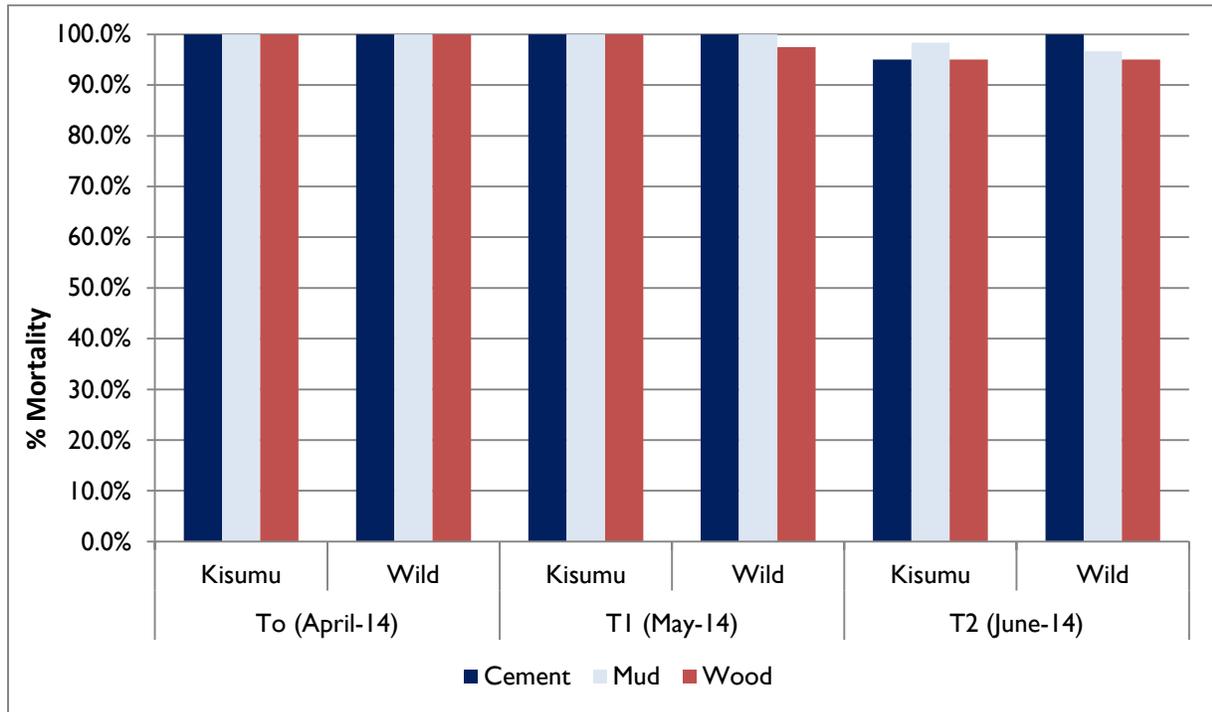
The spray quality was indirectly estimated from the percentage mortality of the exposed mosquitoes from the WHO cone bioassay on the different types of sprayed surfaces (mud, wood and cement). The results for the tests are all presented in Figures 2-6 below.

FIGURE 2¹³: PERCENTAGE MORTALITY OF ANOPHELES GAMBIAE S.L. FROM SPRAY QUALITY CONE WALL BIOASSAYS CONDUCTED FOR 2014 SPRAY OPERATIONS



¹³ **Tarikpaa:** sprayed on 15th & 16th April 2014 and tested on 17th April 2014;
Nanton: sprayed on 25th & 26th April 2014 and tested on 26th and 28th April 2014;
Bunbuna: sprayed on 18th April 2014 and tested on 23rd April 2014 & 2nd May 2014;
Gbangu: sprayed on 24th April 2014 and tested on 25th April 2014.

FIGURE 3¹⁴: PIRIMIPHOS METHYL DECAY RATE (% MORTALITY OF ANOPHELES GAMBIAE) IN TARIKPAA 1 & 2 MONTHS AFTER SPRAYING IN APRIL 2014



¹⁴ **Tarikpaa:** sprayed on 15th & 16th April 2014.

FIGURE 4¹⁵: PIRIMIPHOS METHYL DECAY RATE (% MORTALITY OF ANOPHELES GAMBIAE) IN NANTON 1 & 2 MONTHS AFTER SPRAYING IN APRIL 2014

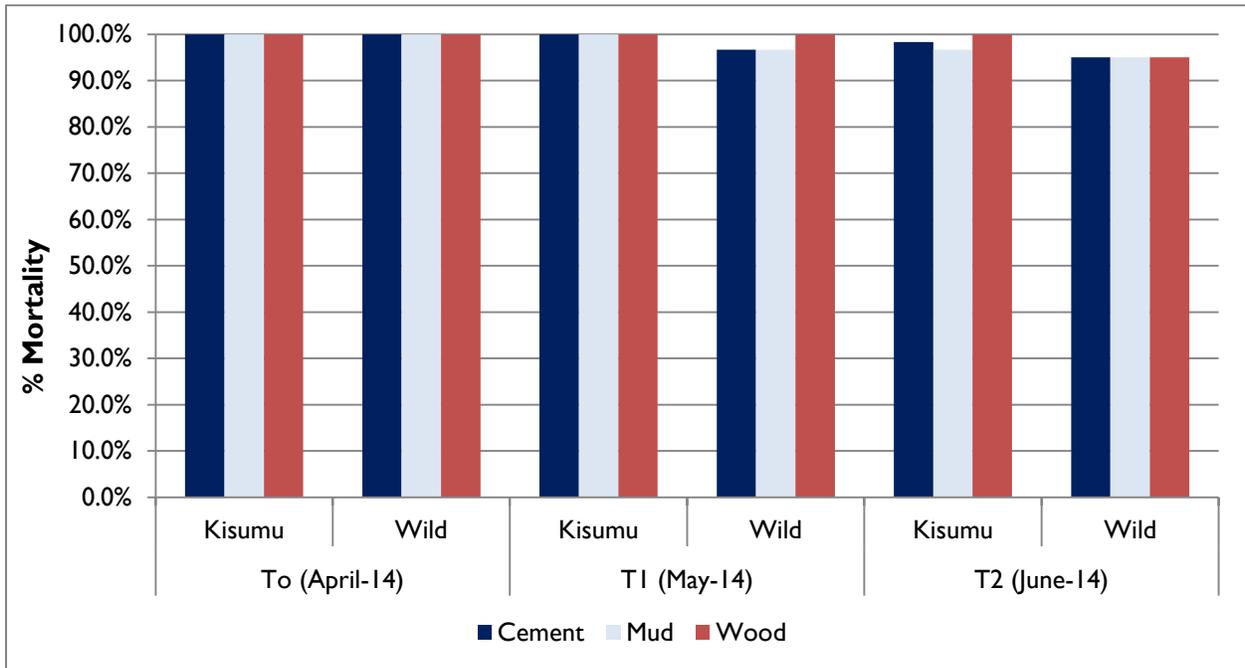
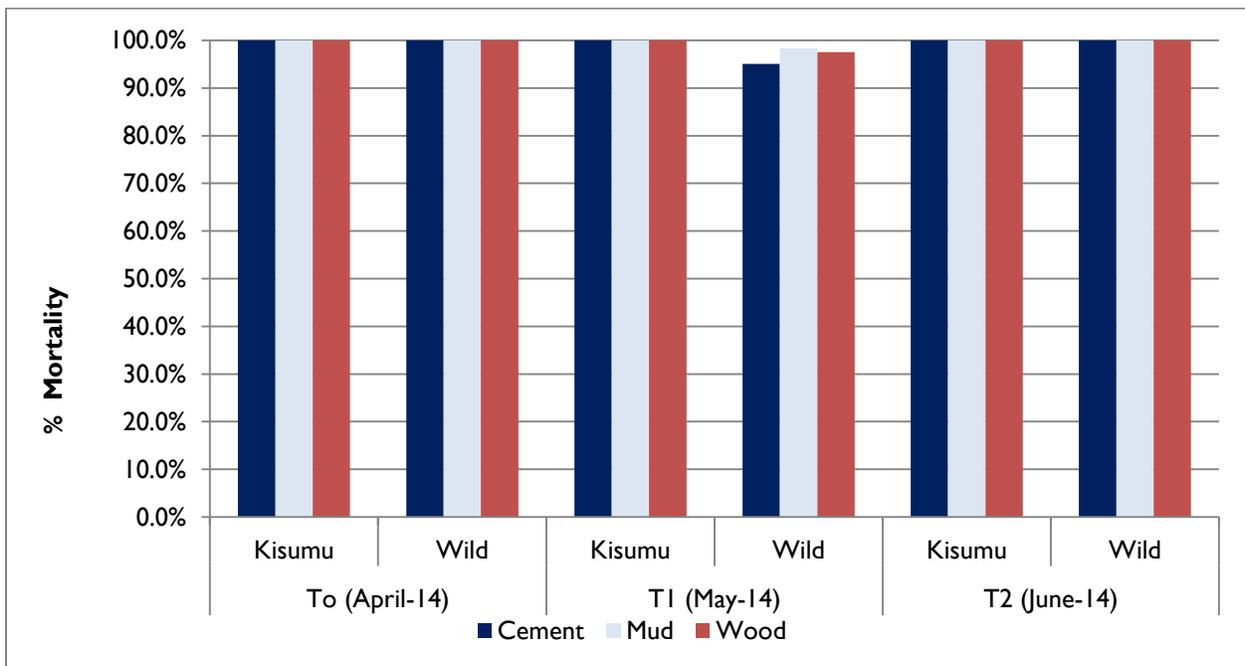


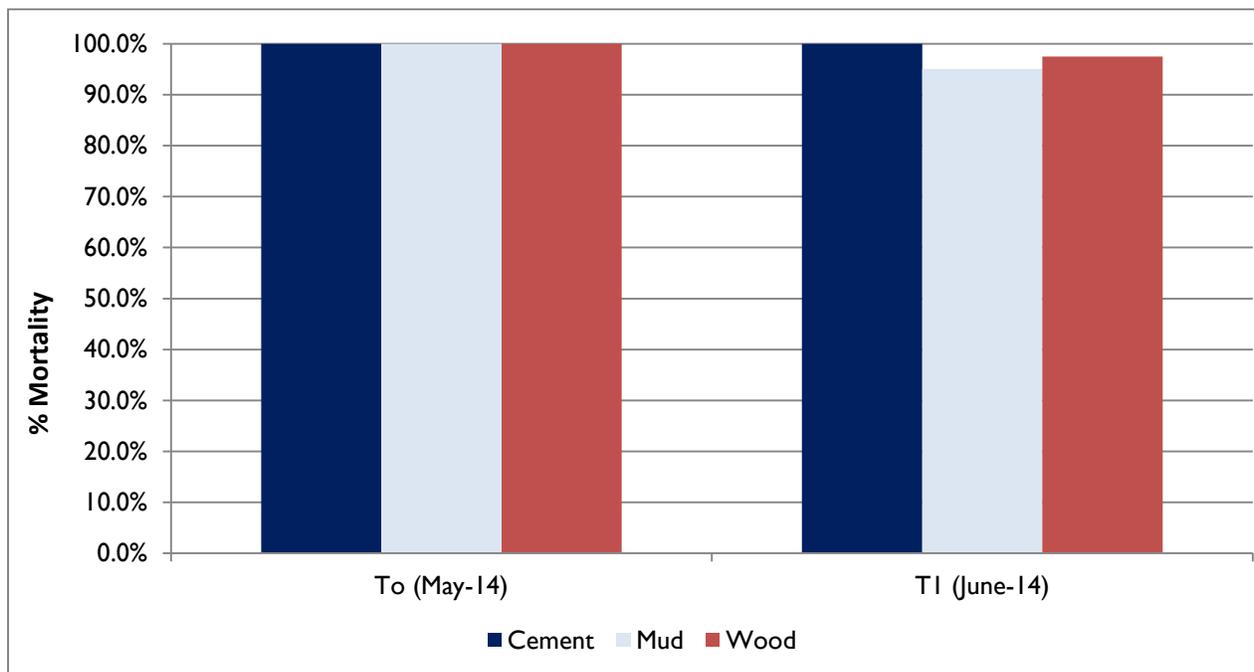
FIGURE 5¹⁶: PIRIMIPHOS METHYL DECAY RATE (% MORTALITY OF ANOPHELES GAMBIAE) IN BUNBUNA 1 & 2 MONTHS AFTER SPRAYING IN APRIL 2014



¹⁵ Nanton: sprayed on 25th & 26th April 2014

¹⁶ Bunbuna: sprayed on 18th April 2014

FIGURE 6¹⁷: PIRIMIPHOS METHYL DECAY RATE (% MORTALITY OF ANOPHELES GAMBIAE) IN YUNYOO 1 MONTH AFTER SPRAYING IN MAY 2014



6.2 IMPACT OF SPRAY OPERATIONS ON INDOOR RESTING DENSITY, BITING RATE AND PARITY

6.2.1 MOSQUITO COLLECTIONS

Mosquito collections were carried out in four sentinel districts to assess and understand the effect of IRS on vector species composition, density, and biting behavior of the local vectors in the area where spraying took place, and to compare with other unsprayed communities. Pre-spray and post-spray mosquito collections were carried out using the Human Landing Catch (HLC) and Pyrethrum Spray Collection (PSC) methods to collect mosquitoes from the sentinel sites. Collections were done four times in each month, from January to June 2014.

The districts and their corresponding communities selected for the entomological surveillance are presented below:

IRS Districts:

- Savelugu-Nanton District: Diare, Nanton and Tarikpaa
- Bunkpurugu-Yunyoo District: Bunbuna, Yunyoo, Nasuan and Sambiruk

Districts without IRS:

- Tolon-Kumbungu District: Dimabi, Gbullung and Woribugu (IRS was withdrawn in 2013).
- Tamale Metropolis: Kulaa, Tugu and Yong (comparison communities)

¹⁷ Yunyoo: sprayed on 6th May 2014

The human landing catches were conducted using eight trained mosquito collectors in each community, to determine the biting behavior of malaria vectors in the area. In each community, the collectors worked in two teams of four, in two houses each night. In each house, two collectors worked indoors while the other two worked outdoors, using a total of four nights to evaluate eight compounds in the community per month.

The PSCs were also used to determine indoor resting mosquito species and their densities. The collections were done the next morning (between 6 and 7 AM) after the HLCs. Thus, a total of eight rooms were surveyed for each community every month.

6.2.2 RESULTS

6.2.2.1 VECTOR SPECIES COMPOSITION

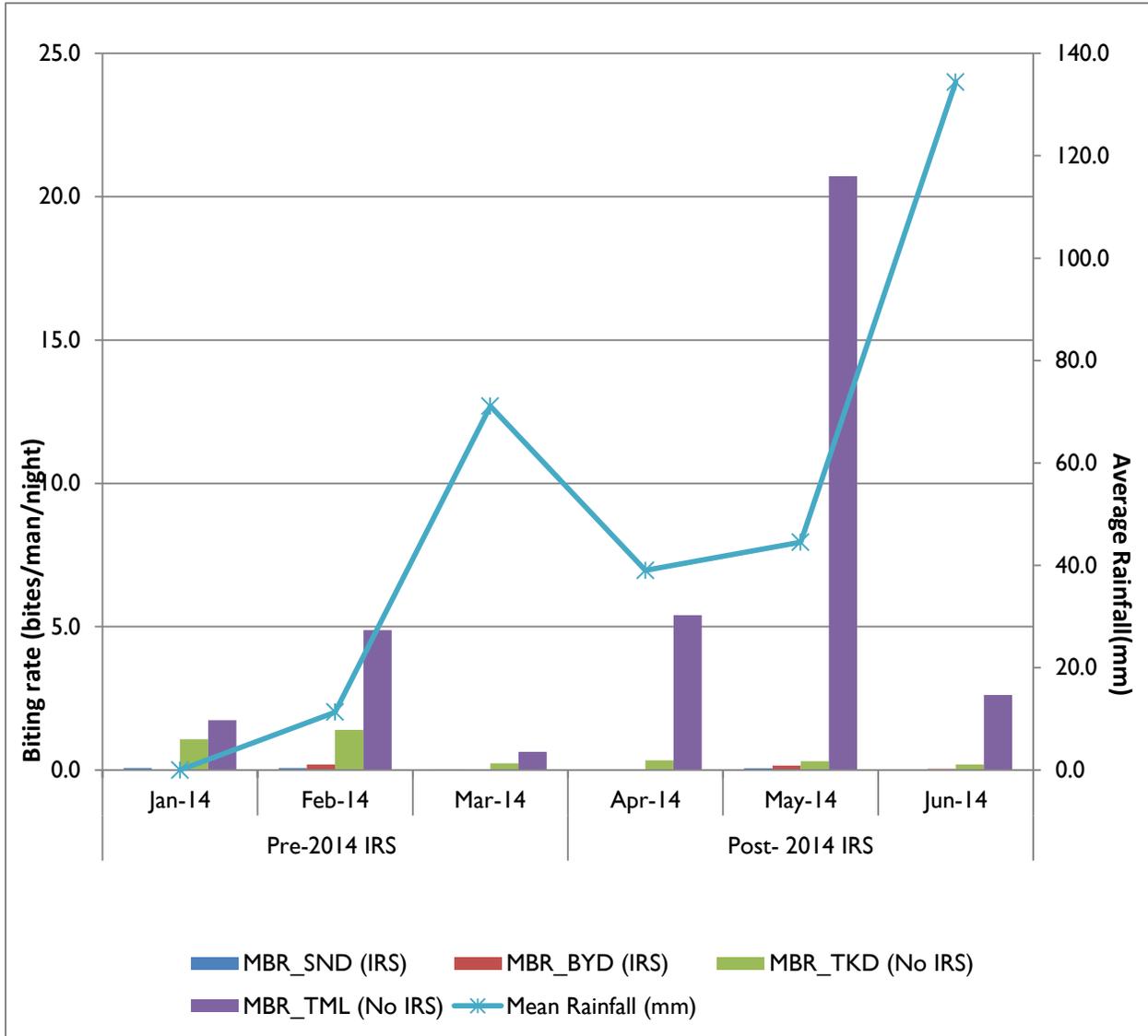
The *Anopheles* species collected included *An. gambiae* s.l., *An. funestus* group, *An. pharoensis*, *An. rufipes* and *An. nili*, with *An. gambiae* s.l. forming about 96.4% (n= 4197) of the total number of anopheline mosquitoes (n= 4355) collected within the period (January to June 2014) while *An. funestus* and *An. nili* formed 1.5%(n=67) and 1.8% (n= 77) respectively. The other *Anopheles* species formed just about 0.3% of the total number of anophelines collected.

6.2.2.2 BITING RATES

The results of the mean man-biting rates of *An. gambiae* s.l. (the predominant vector species), presented in Figure 7, show a general increase in *An. gambiae* biting rates from the pre-IRS period (January to March 2014) through the post-IRS period (April and May 2014) in Tamale (the unsprayed district). However the biting rates declined from about 21 bites/man/night (b/m/n) in May to about 3b/m/n in June 2014. The biting rates in the IRS districts on the other hand remained low.

Comparing the mean man-biting rates (MBR) of the sprayed communities to that of comparison communities showed a statistically significant difference between mean number of bites received by a person in an IRS district (Savelugu-Nanton District and Bunkpurugu-Yunyoo District). The mean MBR for SND (0.04 b/m/n) and BYD (0.07 b/m/n) were significantly lower than mean biting rates 0.60 recorded for TKD and 6.0 b/m/n for Tamale ($p < 0.05$)

Figure 7¹⁸. Man Biting Rates of Female Anopheles Gambiae Mosquitoes Collected Each Month from the Sentinel Communities during the Period (January 2014 to June 2014)

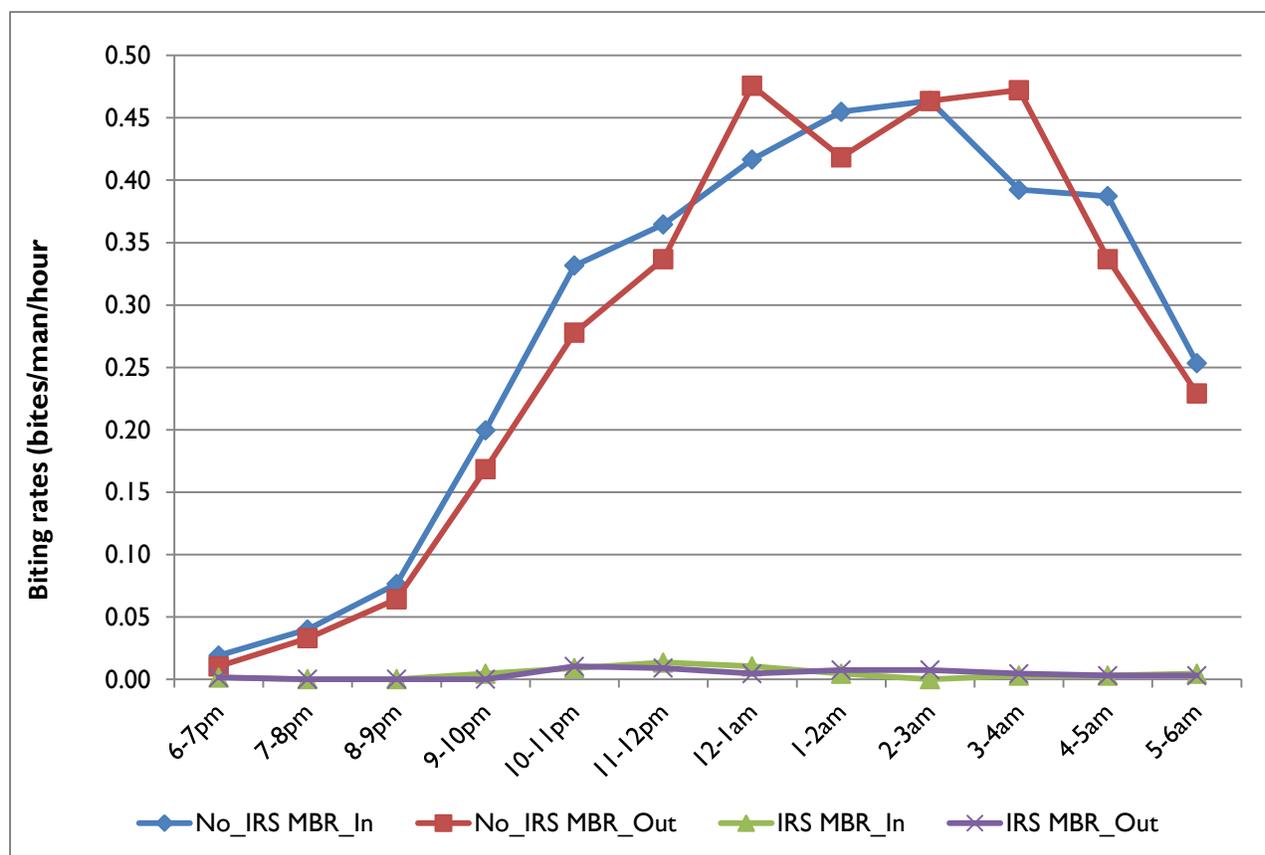


¹⁸ SND= Savelugu-Nanton District, BYD= Bunkpurugu-Yunyoo District, and TKD= Tolon-Kumbungu District

6.2.2.3 HOST-SEEKING BEHAVIOR

There was no significant difference in the Post IRS biting behavior (the preference of malaria vectors to either feed indoor or outdoor) for the IRS districts Savelugu-Nanton ($F_{(1,10)} = 0.192$, $p = 0.670$ and Bunkpurugu-Yunyoo District: $F_{(1,10)} = 0.037$, $p = 0.851$) and for the unsprayed comparison districts, Tolon-Kumbungu ($F_{(1,10)} = 0.00$, $p = 0.992$) and Tamale Metropolis ($F_{(1,10)} = 0.00$, $p = 0.989$).

Figure 8. Host seeking behavior of *An. gambiae* collected inside and outside unsprayed houses in Tamale and Tolon Kumbungu (above) and sprayed houses in Savelugu Nanton and Bunkpurugu-Yunyoo (below)



6.2.2.4 PARITY RATES OF VECTOR SPECIES

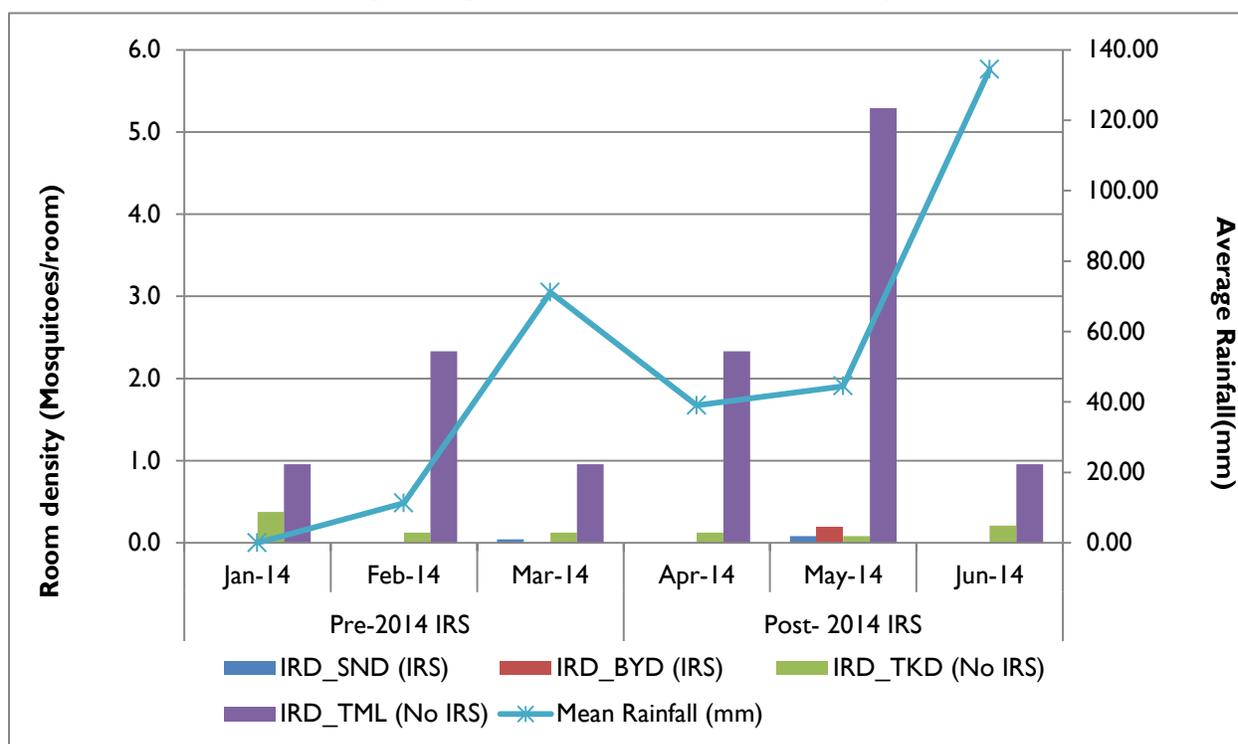
Dissections on *An. gambiae* s.l. mosquitoes collected from the study sites between January 2014 and June 2014, revealed a relatively higher proportion of older anopheline populations in the unsprayed communities than in IRS areas. The unsprayed districts Tamale and Tolon Kumbungu recorded mean parity rates of 78.6% (497 of 632 dissected) and 75.7% (106 out of 140 dissected) respectively. Due to low numbers of mosquitoes collected for the IRS areas, low numbers of *An. gambiae* s.l. were dissected for SND and BYD. The parity rates recorded for the IRS Districts SND (23.1%; 3 out of 13 dissected) and BYD (24.2%; 8 out of 33 dissected) significantly different from parity rates recorded for unsprayed districts ($p < 0.05$). There was no significant difference in mean parity rates of mosquitoes collected from the comparison districts of Tamale (78.6%) and Tolon-Kumbungu District (75.7%) ($F_{(1,10)} = 4.804$, $p = 0.053$) where IRS was carried out in 2012, but exempted from IRS in 2013.

6.2.2.5 VECTOR DENSITIES

Results obtained from the PSCs conducted during the period showed that the comparison districts recorded higher vector densities than the IRS districts (Figure 8 below). There was a significant difference between IRDs for TKD (0.17 mosquitoes/room) and that for SND (0.02 mosquitoes/room; $F_{(1,12)} = 16.015$, $p = 0.002$) and for IRD for BYD (0.03 mosquitoes/room; $F_{(1,12)} = 9.947$, $p = 0.008$). The IRDs for SND and BYD were also significantly lower than IRDs recorded for Tamale (2.14 mosquitoes/room; for SND: $F_{(1,12)} = 13.293$, $p = 0.003$ and for BYD: $F_{(1,12)} = 13.127$, $p = 0.003$).

Figure 8, also show a general increase in indoor resting densities of *An. gambiae* from the pre-IRS period (January to March 2014) through the post-IRS period (April and May 2014) in the Tamale (the unsprayed district) IRDs. However as observed in the biting rates (figure 6), the IRDs for Tamale also declined sharply in June from 5.29 mosquitoes/room recorded in May to 0.96 mosquitoes/room. This could in part be due to a recent second round nationwide LLIN distribution to primary 2 and primary 6 pupils and pregnant women by Networks (USAID contractor), which took place in late May 2014. Primaries 2 and 6 pupils and pregnant women in most homes that were surveyed had been given these LLINs. This reduction in both biting rates and IRDs recorded in June could also be attributed to possible flooding and washing out of breeding sites due to the relatively high mean rainfall (134.40mm) recorded in June. These factors seem to account for the patterns observed in biting rates and IRDs recorded in June.

Figure 9¹⁹: Indoor Resting Densities of *An. Gambiae* S.L. collected from Sprayed Rooms in Savelugu-Nanton and Bunkpurugu-Yunyoo and from Unsprayed Rooms in Tamale and Tolon-Kumbungu using the PSC Method from January to June 2014



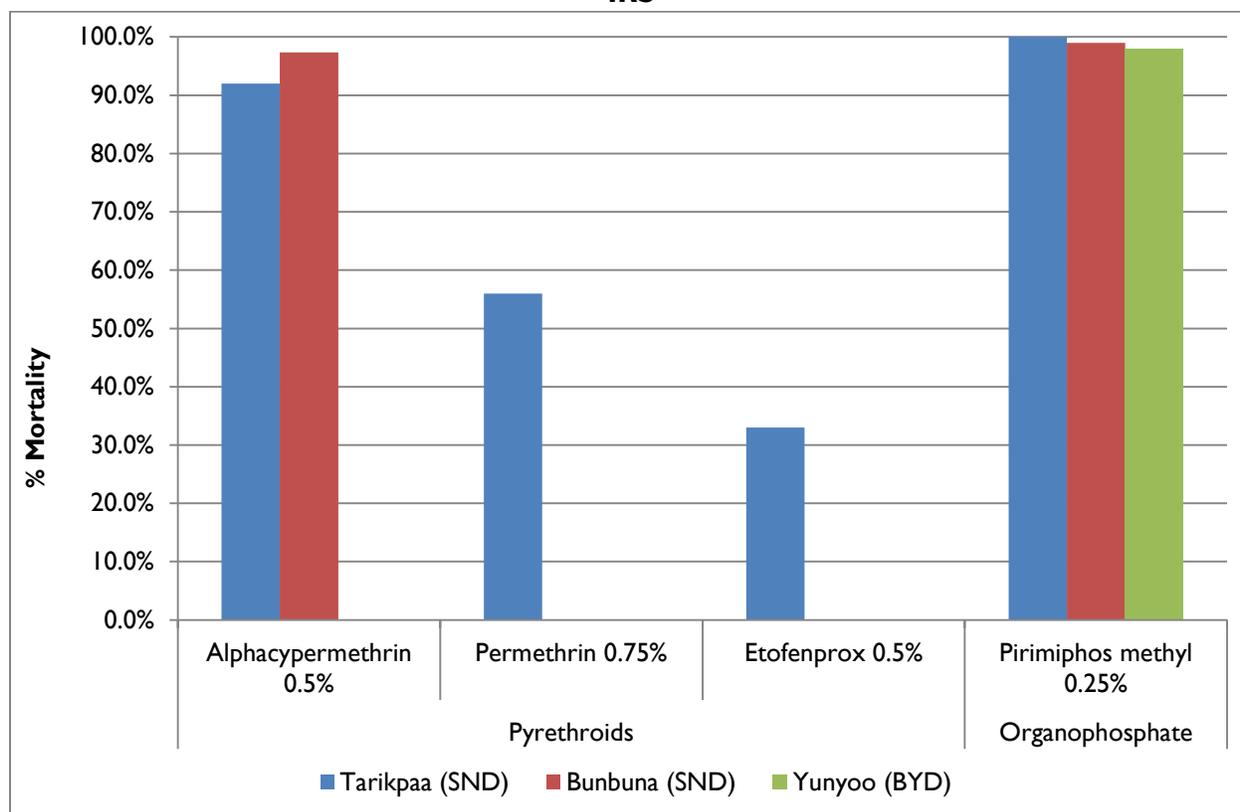
¹⁹ SND= Savelugu-Nanton District, BYD= Bunkpurugu-Yunyoo District, TKD = Tolon-Kumbungu District, and TML = Tamale Metropolis.

6.3 INSECTICIDE SUSCEPTIBILITY TESTS

Local *An. gambiae* s.l species collected from the IRS sentinel communities were tested against selected WHO-approved insecticide for IRS, using the WHO Tube assays methodology. The insecticides tested included; Alphacypermethrin 0.5%, Permethrin 0.75%, Etofenprox 0.5%, and Pirimiphos methyl 0.25%. The 24-hour mortalities were recorded.

The results of the insecticide susceptibility tests conducted in June 2014 are presented in Figure 10 below, show that the local vector species from the IRS communities tested were susceptible to the organophosphate insecticide tested. However, local *An. gambiae* s.l from the Tarikpaa in SND appeared resistant to permethrin and etofenprox, but potentially resistant to alphacypermethrin. Further tests are being carried out, and the results of insecticide susceptibility tests represent only the period up to the end of June 2014. The tests are ongoing and results will be updated when completed.

Figure 10²⁰. Insecticide susceptibility status of local *An. gambiae* mosquitoes from entomological sentinel sites tested against selected WHO recommended insecticides for IRS



6.4 CONCLUSIONS AND RECOMMENDATIONS

The target of the AIRS project is to primarily reduce malaria transmission through reduction in key malaria vector transmission indices, by a reduction in vector survivorship and density, and human-vector

²⁰ SND= Savelugu-Nanton District, and BYD= Bunkpurugu-Yunyoo District.

contact. Key amongst the critical requirements for these goals to be achieved is the need for high quality of spraying during the campaign.

The results of the entomological surveys showed high quality of spraying by the spray teams. The results also show that the IRS communities recorded relatively low vector densities and low proportion of parous (older) female *Anopheles* mosquitoes. These effects on the transmission indices could be attributed to the impact of pirimiphos methyl (Actellic 300CS) in killing high proportions of the older females *Anopheles* mosquitoes that rest in the rooms, since the local vector species in the area are still susceptible (ranging between 98.7% to 100%) to pirimiphos methyl used for the IRS operations in 2014.

Entomological monitoring will continue to be conducted to assess the impact of the AIRS operations on malaria transmission in the Northern Savannah zone of Ghana, and provide important feedback for decision making in future IRS operations.

7. ENVIRONMENTAL COMPLIANCE

7.1 PRE-SEASON ASSESSMENT

It is important that environmental procedures are in place to ensure safe disposal of insecticides and other wastes. The AIRS Environmental Compliance Officer, the District Assembly Environmental Officers and officials from Ghana Environmental Protection Agency (EPA) undertook a formal joint Pre-Season Environmental Compliance Assessment (PSECA) to assess all 16 operational sites in the four targeted districts from February 5 to 14, 2014. All 16 soak pits constructed in 2011 and existing storage facilities appeared to be in good condition. However, based on recommendation from the PSECA, some operational sites were refurbished to meet standard operational requirements. Based on recommendations from the PSECA report, two soak pits (one in Bunkpurugu Yunyoo and one in West Mamprusi) were relocated because the storage facilities co-located to them were no longer fit for IRS operations. Alternative facilities were arranged and the soak pits were also relocated. Minor renovations including repainting of storage facilities and refilling of soak pits were carried out on the other soak pits and storage facilities.

PSECA data collection was done through the use of smart phone data collection technology that was introduced in 2013. A letter report was written and submitted to PMI that summarized key environmental compliance indicators.

7.2 MID-SEASON ENVIRONMENTAL COMPLIANCE ASSESSMENTS

The AIRS Environmental Compliance Officer, District Environmental Health Officers and the USAID Environmental Health Officer visited all 16 sites in the four districts to provide technical assistance to district teams on environmental compliance. The team also used this opportunity to conduct mid-season environmental compliance assessments for all the sites. During the exercise, the team used the 2014 supervisory forms described in Table 10 to ensure that district staff adhered to standards for IRS operations. Particular emphasis was placed on the safety of the IRS workers and the community, proper storage of insecticides, stock control and inventory procedures, effluent waste disposal, and proper spill response procedures. Special attention was given to the appropriate use of PPE, proper handling of insecticide, and mixing procedures including the triple rinse process for empty Actellic 300 CS bottles. During the assessments, the team observed that all the sites met the minimum standards for IRS operations.

7.3 POST-SEASON ENVIRONMENTAL COMPLIANCE ASSESSMENT

All storage facilities and soak pits at the 16 operational sites were cleaned and were kept locked with danger warning signs embossed on the fence and walls of the facilities. The facilities are guarded 24 hours per day. Annex B provides more information on the post-season environmental assessment.

7.4 WASTE DISPOSAL

All solid waste materials were disposed of in accordance with the PMI/IRS BMP. Three main forms of solid waste were generated during the 2014 IRS campaign:

- Empty triple-rinsed bottles of Actellic CS (organophosphate)
- Used nose masks

- Well-washed damaged hand gloves and boots

All used nose masks, excavated charcoal and saw dust (weighing 1,483 kg) were successfully incinerated at ZEAL Oil Company in Tarkoradi from July 21 to August 12, 2014. The 44,948 empty Actellic 300 CS bottles were sent to Cyclus Elmina Plastic Recycling Company in the first week of July 2014 for recycling. The recycling was witnessed by the AIRS Environmental Compliance Officer and a representative from the EPA. The well-washed used coveralls and punctured boots were packaged and await proper disposal. AIRS Ghana is discussing how best to dispose of these items with the EPA because incineration is not appropriate for this type of solid waste (chlorinated rubber). The detailed pre, mid and post spray reports are attached as Annex B.

8. MONITORING AND EVALUATION

8.1 KEY OBJECTIVES AND APPROACH

The AIRS Ghana monitoring and evaluation systems drew strength from previous year's experiences, lessons learned, and best practices that were shared across AIRS countries.

As outlined in the 2014 work plan, the M&E approach was to use lessons learned to:

- Emphasize accuracy of both the data collection and the data entry process through comprehensive training and supervision at all levels;
- Streamline and standardize data and information flow to minimize errors and facilitate timely reporting;
- Ensure IRS data security and storage for future reference through establishment and enforcement of proper protocols;
- Communicate IRS data and information to stakeholders in a timely and clear manner.

8.2 DATA COLLECTION AND DATA MANAGEMENT

Data was collected using standardized data collection forms designed to capture all core PMI indicators. All data collection was preceded by training data collectors (mobilizers, SOPs, District M&E Coordinators, etc.) on data capture. Mobilization data was collected by mobilizers (IEC implementers and CBS Volunteers) during house-to-house mobilization. During spray operations, all spray data was collected by SOPs and verified through data quality processes.

Table 11. Ghana IRS 2014 Data Collection Tools, describes all the data collection tools that were used during the 2014 spray campaign.

TABLE 11. GHANA IRS 2014 DATA COLLECTION TOOLS

Data collection tool	Used by who and when
Training Participants Registration Form	Used by lead trainer at training workshop to capture category and number of people trained, disaggregated by male and female.
BCC/IEC Mobilization Form (MO 1)	Used by IEC mobilizers during pre-spray house-to-house mobilization/sensitization activities to collect data on number of households and people reached with IRS messages.
Daily SOP Form	Used by SOPs during spray operations to capture structures found, structures sprayed and not sprayed, population protected and unprotected as well as mosquito net information.

In 2013, the AIRS project introduced standardized data quality assurance tools - the Error Eliminator (EE) and Data Collection Verification (DCV) to improve supervision, and ultimately the quality of data collection and data entry. Table 12 describes the data quality assurance tools and who is to use them.

TABLE 12. DATA QUALITY ASSURANCE TOOLS

Data Quality Assurance Tool	Purpose, Used by who and when
Error Eliminator (EE) form	Purpose: <ul style="list-style-type: none"> • To check the completeness and correctness of data collected in the field. • To highlight common data collection errors so they can be quickly identified with corrections being made and re-training provided by the supervisor. Used by: <ul style="list-style-type: none"> • Team leaders on daily basis to check 100% of the forms filled by the SOPs under their supervision. • Supervisors, District Spray Operations Coordinator, District M&E Coordinators, Operations Manager and M&E Manager also used the Error Eliminator when visiting the field.
Data Collection Verification (DCV) form	Purpose: <ul style="list-style-type: none"> • Used during random household visits to check the accuracy of data collected in the field– i.e., to ensure that the data written on the Daily SOP Forms matches the information reported by households and/or the data recorded on the IRS Cards disseminated to households. Used by: <ul style="list-style-type: none"> • District M&E Coordinators, predominately • Database Manager and the M&E Manager. • A total of 1, 501 households/compounds were visited using the DCV form. See Tables 15 and 16.

Supervision of the data collection process was carried out at various levels through field visits. Table 13 tabulates the levels of data collection supervision provided.

TABLE 13. LEVELS OF DATA COLLECTION SUPERVISION

Data	Supervised by
Mobilization data	District IEC Assistant, District M&E Coordinator, Regional Level IEC Coordinator, M&E Manager, Operations Manager
Spray Data	Team Leader, Field Supervisor, District M&E Coordinator, Regional M&E Manager, Database Manager and Operations Manager.

TABLE 14. NUMBER OF HOUSEHOLDS/COMPOUNDS VISITED USING THE DCV FORM

District	# Households/Compounds visited using the DCV form
Bunkpurugu-Yunyoo	335
East Mamprusi	321
Savelugu-Nanton	422
West Mamprusi	585
Total Households visited	1,663

TABLE 15. USE OF DCV FORM: COMMON ISSUES FOUND AND CORRECTIVE ACTIONS TAKEN

Errors/Issues Observed	Corrective Actions Taken
Understatement of total number of eligible structures found by SOPs. It was observed that in compounds where some structures were locked, SOPs did not always count them as part of the total number of eligible structures found.	The M&E team provided correction regarding this error to SOPs, Team Leaders and field supervisors. It was emphasized that all eligible structures were to be counted whether locked or open. Spray teams were to probe further concerning the eligibility of structures especially when the structure was locked.
Overstatement of total number of eligible structures found. In some compounds, some new SOPs over counted the number of eligible structures by counting the number of rooms as though they were structures. Also, some SOPs over counted the total number of eligible structures by counting food stores and traditional shrines (especially when these structures were locked at the time of visit). Additionally, in some compounds, households convinced SOPs that structures that were under construction at the time of visit would be ready for occupancy in the next few days and thus eligible. These structures were counted as eligible with the hope that they would be ready for spraying during a revisit, but many were not completed in time to be covered during the revisit to the compound and thus should not have been counted as eligible.	The M&E team addressed SOPs, Team Leaders and field supervisors asking them to take note of these common errors and to be careful in determining the eligibility of structures before recording them. Spray teams were reminded that the eligibility to a structure was based on evidence at the time of the visit, not on its future eligibility.
Overstatement of total number of eligible structures sprayed. Prior to the 2014 spray campaign, focus group discussions revealed that some SOPs inflated the number of structures sprayed in the 2013 campaign. The motivation for this varied. In some cases it was driven by SOPs wanting to “look good” to supervisors while in other cases it was because SOPs wanted to have to avoid mop-up/revisits to the same community.	Before IRS operations started, the SOPs were cautioned about this error. Team Leaders and Supervisors intensified field spot checks in 2014 to ward off this error. However, 12 SOPs in Savelugu were still detected intentionally committing this error. These SOPs were fired for overstating the number of structures sprayed and for reporting to have sprayed structures that they had not sprayed. The SOPs that were dismissed were also found to be not counting structures in which the owners refused/denied access. All affected compound data was corrected.

Errors/Issues Observed	Corrective Actions Taken
<p><i>Undercounting of number of structures sprayed:</i> It was observed in some compounds that the number of sprayed structures were undercounted. This was specific to very large compounds where SOPs had to make their way through different courtyards in the same compounds.</p>	<p>The M&E team addressed SOPs, Team Leaders and field supervisors asking them to take note of this error and to be careful in counting both eligible and sprayed structures especially in large compounds with different courtyards.</p>

8.3 DATA ENTRY

AIRS employed twelve Data Assistants (three per district) to enter all mobilization and spray data generated from the four districts. The project laptops procured in 2012 were used for the 2014 spray round data entry in addition to eight extra laptops that were procured in 2014 due to the increased number of Data Assistants and database setup which entailed using a server computer in each data entry center. The 2014 AIRS Ghana database was installed on each laptop. Data was entered simultaneously in each of the four districts. Data entry was carried out at two levels, first by “Totals” (i.e. data entry by the total lines of each form) for quick reporting and feedback, then by “Details” (i.e. data entry by detail data for each compound) for more accurate data entry and verification purposes.

8.4 DATA STORAGE

Data cards are stored in arc files (binders). Mobilization data cards were filed in separate binders by sub-district and within each binder by Zone and then by community. Spray data were filed in arc files by sub-district, with the forms in each file sorted by spray date.

At the end of every day, all databases were backed up electronically. Backup was performed in three different ways: first, into a backup folder on the laptop which served as the district data entry server; second into a cloud back-up system (Sugar Sync); and third onto an external flash drive that was provided to each Data Assistant. All computer and flash drives are secured in the IT office in Tamale under lock and key.

8.5 DATA CLEANING

Data cleaning was done by Data Assistants at the district level and involved the following:

- Ensuring that all data cards are entered correctly by the double entry method (by Totals and by Details)
- Ensuring that all necessary corrections are made so that the Totals and Details data entry balance.
- Checking and removing duplicate records.
- Identifying and entering missing records.

Data cleaning was done using a Microsoft Access-based IRS Cleaning/Reporting tool. The Data Assistants cleaned both spray and mobilization data daily throughout the spray campaign with final data cleaning completed within 8 days of the end of the spray campaign.

TABLE 16. DATA QUALITY ASSURANCE AND CONTROL (QA/QC)

QA/QC Issue	Method/Tools for Quality Assurance
Spray data integrity	<ul style="list-style-type: none"> • Used standardized data collection forms. • Comprehensive training for spray data capture. • Multiple levels of supervision. • SOPs were supervised directly by their Team Leaders. • Supervisors monitored the Team Leaders and verified SOP forms. • M & E Manager, Database Manager and District M&E Coordinators monitor and verified data capture by SOPs, Team Leaders and Supervisors. • Structure spot checks to cross-check daily spray data captured by SOPs. • Database designed with locks and validation checks. • Use of Error Eliminator and Data Collection Verification forms to ensure complete and accurate data collection. • Compare number of compounds sprayed with number of compounds mobilized, to address the issue with missed compounds.
Mobilization Data Integrity	<ul style="list-style-type: none"> • Used standardized data collection forms. • Comprehensive training for mobilization data capture. • Multiple levels of supervision (by IEC Assistants, M&E coordinators and Spray Operations Coordinator, IEC Coordinator, M & E Manager, Database Manager). • Household visits for spot checks. • Database designed with locks and validation checks. • Use of Error Eliminator to ensure complete and accurate data collection.
Spray Data Entry and Management	<ul style="list-style-type: none"> • Data entry training for all Data Assistants • Prompt field data entry and transfer; data collection forms arrived at data entry sites daily and data entry was also done on a daily basis • Data entry via double-data entry method <ul style="list-style-type: none"> ▪ Initial data entry of totals per data collection form ▪ Follow-up entry of details data, i.e. data per individual household/compound • Data scan for irregularities by Database Manager and IRS supervisory staff. • Use of Microsoft Access-based IRS Cleaning/Reporting tool to daily clean data.
Data Security	<ul style="list-style-type: none"> • Data collection forms were printed on durable sheets. • Paper data collection forms filed systematically in arc files. • Database was designed with passwords to restrict unauthorized entry. • Databases backed up daily on the server laptop, on Sugar Sync, and on external pen drives.

8.6 POST SPRAY DATA QUALITY AUDIT (PSDQA)

As part of data quality assurance strategies, AIRS Ghana conducted an internal Post Spray Data Quality Audit (PSDQA). The objectives of the PSDQA were:

- Validate the spray coverage reported by AIRS Ghana for the 2014 spray round.
- Validate the proportion of people protected reported by AIRS Ghana for the 2014 spray round.
- Identify lessons learned and incorporate best practices for data collection and data entry for the remainder of the AIRS Ghana project.

The PSDQA was conducted between July 2-9, 2014. The findings and details of the PSDQA will be shared with the PMI team in a separate report.

8.7 RESULTS

The complete list of all program indicators for the 2014 spray campaign is presented in the Monitoring and Evaluation Plan matrix in Annex D. The following sections provide summaries on the core PMI indicators and other spray indicators.

A total of 244,799 structures were found by SOPs during the 2014 spray campaign. SOPs found 53,269 structures in Bunkpurugu Yunyoo, 66,725 in East Mamprusi, 49,408 in Savelugu Nanton and 75,379 in West Mamprusi.

Across the four districts, 205,230 structures were sprayed by SOPs, yielding total spray coverage of 83.8 percent. It is noteworthy that spray operators found and sprayed more structures in 2014 than in 2013. In 2014, Spray Operators found 27,923 more structures and sprayed 7,575 more structures compared to 2013. Details of number of structures found, sprayed, and district spray coverage are presented in Table II.

There were 637,370 people counted as living in the total number of structures found by SOPs. Of this number, 89.5 percent (570,572 people) were protected through IRS. The total number of people protected included 12,538 pregnant women and 105,983 children under the age of five years. Details are presented in Table II.

TABLE II. SUMMARY OF 2014 SPRAY RESULTS

District	Structures Found by SOPs	Structures Sprayed	% of Structures Sprayed	Pop. Protected	Pop. Not Protected	% of Pop. Protected	# Preg. Women (% of Pop Protected)	# Children <5 Years (% of Pop Protected)
Bunkpurugu-Yunyoo	53,269	49,370	92.7%	120,755	5,906	95.3%	2,320 (1.9%)	19,742 (16.3%)
East Mamprusi	66,725	58,245	87.3%	167,401	13,746	92.4%	4,040 (2.4%)	32,316 (19.3%)
Savelugu-Nanton	49,408	33,573	68.0%	97,775	27,198	78.2%	1,931 (2%)	17,992 (18.4%)
West Mamprusi	75,397	64,042	84.9%	184,641	19,948	90.3%	4,247 (2.3%)	35,933 (19.5%)
Total	244,799	205,230	83.8%	570,572	66,798	89.5%	12,538 (2.2%)	105,983 (18.6%)

8.7.3 AVAILABILITY AND USE OF MOSQUITO NETS

Across the four districts, 36,081 households reported having a total of 151,998 mosquito nets available at the time SOPs visited during the 2014 spray campaign. 7,973 pregnant women and 69,001 children under five years of age slept under a mosquito net the night previous to the SOP's visit. See Table 12 for mosquito net indicators presented by district.

TABLE 12. NUMBER AND USAGE OF MOSQUITO NETS

District	Mosquito nets		
	Total mosquito nets Found	# (%) Preg. Women sleeping under mosquito nets the previous night	# (%) Children < 5 sleeping under mosquito net previous night
Bunkpurugu-Yunyoo	32,145	1,483 (63.9%)	13,588 (68.8%)
East Mamprusi	40,242	2,498 (61.8%)	20,322 (62.9%)
Savelugu-Nanton	29,470	1,427 (73.9%)	13,012 (72.3%)
West Mamprusi	50,141	2,565 (60.4%)	22,079 (61.4%)
Total	151,998	7,973 (63.6%)	69,001 (65.1%)

8.7.4 OTHER SPRAY INDICATORS

The four districts received a total of 48,695 bottles of Actellic CS for the 2014 spray operations from the regional stores. A total of 44,948 (92.3%) bottles were used to spray the 205,230 structures. No insecticide was reported missing or damaged, and a total of 3,747 bottles were returned to the regional stores by the districts. Each bottle of Actellic CS sprayed an average of five structures. On average, 373 SOPs worked each day across the four districts. Each SOP sprayed an average of 16 structures a day with an average of 3.6 bottles of Actellic CS used per day as presented in Table 13.

TABLE 13. INSECTICIDE TRACKING AND SOP PERFORMANCE

Indicator	District				
	Bunkpurugu-Yunyoo	East Mamprusi	Savelugu-Nanton	West Mamprusi	Overall
Total bottles received from regional stores	10,271	12,672	11,004	14,748	48,695
Total bottles used	10,151	12,338	8,009	14,450	44,948
Total bottles damaged or lost	0	0	0	0	0
Total bottles leftover (returned to regional office)	120	334	2,995	298	3,747
Average number of structures sprayed per bottle	4.9	4.7	4.2	4.4	4.6
Average number of bottles per SOP per day	4.9	3.4	2.7	3.6	3.6
Average number of SOP worked per day	69	104	85	115	373
Average number of structures sprayed by SOP per day	23.9	16.0	11.3	15.9	16.3

9. CAPACITY BUILDING OF

Capacity building is an ongoing process through which individuals, groups and organizations enhance their ability to identify and meet development challenges. AIRS Ghana's role is to build the knowledge and skills of the Ministry of Health (MoH).

AIRS' guiding partnership principles emphasize the importance of building relationships with local partners and strengthening their skills in areas such as strategic planning, leadership, operating systems (technical) advocacy, organizational management and project development and management.

It is against this background that AIRS Ghana conducted a Country Capacity Assessment in 2013, whose main objective was to evaluate the overall level of capability and capacity of the Ghana NMCP and independent local entities to carry out the technical, operational and management functions to implement an IRS program. The results of the assessment were summarized in a report which was shared with PMI and NMCP. In 2014, AIRS, PMI and NMCP worked together to develop a capacity building plan. Three areas were chosen to provide capacity building assistance by AIRS Ghana and these are: Spray Operations Planning and implementation, Entomology and Monitoring and Evaluation. Some other activities in the plan which were not supported by AIRS will be supported by Anglo Gold Ashanti Malaria Program.

PMI through AIRS has been supporting the National Insecticide Resistance Monitoring Partnership (NIRMOP). This is a partnership that brings together researchers and partners within Ghana to generate and monitor insecticide resistance data in the country. One of the key areas of the partnership has been to provide the framework for sharing data on insecticide resistance in a collaborative way so as to support disease control strategies especially those that require the use of insecticides. The partnership is constituted from members of the MaVCOC of the NMCP and has a secretariat with a coordinator situated at the NMIMR.

In 2013, PMI supported training of biologists and technicians in basic entomology in all ten regions of Ghana. The training, whose objective was to train field personnel to assist in the entomological monitoring activities, was part of the strategy by PMI and the NMCP to establish insecticide resistance monitoring across the country. In 2014, PMI has continued to support the NIRMOP through the provision of funds to be used by the field workers to conduct larvae collections, rearing of mosquitoes, and resistance testing with all four (4) WHO approved classes of insecticides for IRS. Please refer to the capacity building plan (Annex D) for more information.

10. CHALLENGES, LESSONS LEARNED

The following challenges, lessons learned, and recommendations were identified during the 2014 spray campaign.

10.1 CHALLENGES

1. A delay in the delivery of IRS cards/stickers by the vendor delayed the house-to-house mobilization process. It was observed that the local vendor had no capacity to deliver a huge number of cards in a short period of time. In future, the program will consider engaging a vendor even if they are not from Tamale to make sure that they have the capacity to print a large number of IRS cards.
2. Ethnic conflicts in some parts of East Mamprusi District affected spray operations; as a result, Shisha community in Sakogu sub-district was not sprayed. At the time of mobilization and spraying, the community had been burnt down and residents had fled the community.
3. AIRS experienced low IRS coverage in three districts which was very worrisome. The team worked hard to ensure that coverage improved in the districts. One of the strategies used was to generate data for communities and compounds with low coverage (coverage less than 90%). The reports were used by district teams to develop revisit plans and follow-up on specific compounds to ensure that revisits were effective. As described in the IEC section of this report, AIRS worked with several different stakeholders at different levels to enhance and strengthen IEC activities. AIRS Ghana also engaged more mobilizers, packers and effective collaboration with the regional and district health directorates helped to improve spray coverage.

10.2 LESSONS LEARNED AND RECOMMENDATIONS

1. In areas where there is poor coverage, involving more mobilizers and packers makes a huge difference. It is also important to involve Chiefs and Opinion Leaders from the beginning so that issues of refusal are dealt with from the outset by the prominent figures of the community.
2. Using females that have been employed in previous spray campaigns in positions that were perceived to be male dominated (especially Spray Operators and Team Leaders) for outreach programs is an effective way of encouraging more females to participate in IRS activities. Also, using males that have been employed in positions that are perceived as female dominated (like Washers and Water Fetchers) for outreach programs will also help demystify the confusion surrounding the roles that males and females can play on IRS activities.
3. IEC/ BCC activities should be intensified. More women and women's groups should be involved in the dissemination of IEC/BCC messages and men should be encouraged to effectively participate in the preparation of households for spray operations.
4. One IEC Assistant per district is not enough to coordinate all the IEC/ BCC activities at the district level. It is recommended that in the future, there should be one IEC Assistant for each operational site to handle all the IEC/ BCC issues related to the communities under that operational site. This will help to address most IEC/ BCC issues on time.

5. There should be greater collaboration and coordination during the planning stages between the IRS team and other local government departments to ensure that IRS activities are not interrupted by other important national activities. Especially, the collaboration between AIRS, the regional and district health directorates and community leaders should be maintained and improved in future to ensure improved spray coverage. Meetings should be held to discuss IRS IEC/ BCC related issues even after the spray campaign.
6. Maintain the use of radio programs to inform and educate people on IRS activities.
7. Low coverage community/ compounds reports are an effective way to target specific communities and compounds for revisits. This ensures proper use of resources and effective supervision.
8. To avoid delay in house-to-house mobilization in the future, more than one vendor, including those from outside Tamale, should be contracted to print the IRS cards/ stickers in order to reduce the pressure on vendors and speed up the process.
9. Mobilization data should be entered before the start of spray operations. This will help reports on the number of compounds mobilized to be generated on time. The report can also be used to guide the assignment of SOPs to specific compounds to spray and help supervisors to supervise SOPs since they will know which compounds they have visited. Lastly, this will help to avoid having missed compounds during spray operations.

ANNEX A. FULL INVENTORY OF STOCK

2014 International procurement List							
Item	Quantity Before the Campaign	Quantity Procured	Total	Quantity Used	Quantity Damaged	Quantity remaining after campaign	Remarks
Spray Pumps	389 (200 Goizper ik12) (189 Hudson)	80 (Goizper)	469	-	178 in total were damaged (83 Goizper and 95 Hudson)	197 Goizper 125 Hudson	Goizper pumps had minor damages which can be repaired. Most of the Hudson pump were old and therefore got damaged easily
Coveralls	1405	-	1405	-	519	886	Most of the coveralls were old and therefore got damaged easily
Hard Hats	471	96	677	-	128	549	Most of the Hard Hats were old and therefore got damaged easily
Head Gear	599	-	599	-		599	170 old ones retrieved from closed-out districts
Face Shields	209	1,150	1,359	-	260	1,099	
Nose Masks	2,767	21,360 international and 4,000 local	28,127	25,759	-	2,368	
Actellic 300 CS (bottles)	8,267	40,428	48,695	44,948	-	3,747	
Pressure Gauge (for Expert Pump)	120	-	120	22	-	98	
Repair Kit (Xpert pump)	46	-	46	21	-	25	

2014 Local Procurement List							
Item	Quantity Before the Campaign	Quantity Procured	Total	Quantity Used	Quantity Damaged	Quantity remaining after campaign	Remarks
Neck Covers	1,072	-	1,072	-	288	784	
Boots (pairs)	634	-	634	-		634	
Fire Extinguishers	42	-	42	-	-	42	
Daily Spray operators card	5,100	25,000	30,100	27,876	-	2,224	
MOI Cards	-	5,000	5000	5000	-	-	
Spread sheet	600	-	600	533	-	67	
Heavy duty gloves	-	60	60	-	2	58	
IEC Brochures	200	9,800	10,000	8000	-	2000	
IEC welcome the sprayer	1,500	8,500	10,000	7200	-	2800	
IRS STEPS	2000	8,000	10,000	7000	-	3000	
Spray bag	607	-	607	-	157	450	
IRS Cards/stickers	-	48,205	48,205	47,597	608	-	
Hand gloves	989	200	1,189	-	1056	133	Most of the hand gloves were old and therefore got damaged easily
Malaria free poster	1,500	8,500	10,000	7200	-	2800	
Apron	61	-	61	-	8	53	
Stock card	1,585	500	2,085	2085	-	0	
Towels	275	350	625	595	-	30	
2013 Supervisors check list forms	1,473	-	1,473	-	-	1473	These checklist were printed in 2013 and were not used in 2014 because they were replaced with new supervisory checklists

2014 Homeowner Preparation supervisory checklist	0	1,000	1,000	640	0	360		
2014 Morning mobilization supervisory checklist	0	1,000	1,000	350	0	650		
2014 Store Keeper Performance supervisory Checklist	0	1,000	1,000	381	0	619		
2014 End of day clean up supervisory checklist	0	1,000	1,000	408	0	592		
Nose masks	-	4000	Refer to Nose Mask entry on international procurement list					
Cotton Socks	509	200	709	589	-	120		
Rinse Cups	70	260	330	-	146	184		
Pliers	-	30	30	-	-	30		
Padlocks	-	30	30	30	-	-		
Calculators	9	100	109	-	11	98		
Polo shirts	174	1,000	1,174	1,174	-	-		
IEC Supervisor Cards	-	300	300	300	-	-		
Performance Tracker	-	27	27	26	-	1		
Error Eliminator Cards	-	8000	8000	8000	-	-		
Homeowner Preparation Checklist	-	4000	4000	640	-	3360		
SOP Morning Mobilization Checklist	-	4000	4000	381	9	3610		
Storekeeper Performance checklist	-	4000	4000	350	-	3650		
End of Day Clean-up Checklist	-	4000	4000	408	-	3592		

ANNEX B. PRE-, MID-, AND POST-SEASON

TABLE 14: SUMMARY OF PRE-SEASON ENVIRONMENTAL COMPLIANCE ASSESSMENTS - STORAGE FACILITY AND SOAK PITS

Operation site	Facility located an adequate distance from schools, homes, and water bodies	Double locks on pesticide storage	Facility guarded 24 hrs/day	Windows barred and screened	Soak pit fenced, gated, and locked	Danger signs with skull and crossbones	Pesticides properly labeled ²¹	Material Safety Data Sheets (MSDS) readily available in storeroom	Adequate PPE in inventory for the number of operators expected	First aid kits for storeroom fully stocked	Emergency response procedure posted in stockroom (with phone numbers)	Spill response procedure posted	Insecticides past their expiration date	Containers for waste available and clearly marked	Thermometer in storeroom	Spill kits for storeroom	Fire extinguisher inside and outside	Leak-free floor and roof	Soap and water available	Antidotes to pesticides available nearby	Storeroom supervisors know signs of poisoning and location of nearest treatment facility	Pregnancy tests administered
Moglaa	Yes	Yes	Yes	Yes	Yes	Yes	N/A	Yes	Yes	No	Yes	Yes	N/A	Yes	No	No	No	Yes	Yes	Yes	No	No
Zoggu	Yes	Yes	Yes	Yes	Yes	Yes	N/A	Yes	Yes	No	Yes	Yes	N/A	Yes	No	No	No	Yes	Yes	Yes	No	No
Diare	Yes	Yes	Yes	Yes	Yes	Yes	N/A	Yes	Yes	No	Yes	Yes	N/A	Yes	No	No	No	Yes	Yes	Yes	No	No

²¹ N/A means that at the time of the Pre-spray inspection, that indicator could not be assessed. Those indicators were assessed during the mid-spray and post spray inspections.

Operation site	Facility located an adequate distance from schools, homes, and water bodies	Double locks on pesticide storage	Facility guarded 24 hrs/day	Windows barred and screened	Soak pit fenced, gated, and locked	Danger signs with skull and crossbones	Pesticides properly labeled ²¹	Material Safety Data Sheets (MSDS) readily available in storeroom	Adequate PPE in inventory for the number of operators expected	First aid kits for storeroom fully stocked	Emergency response procedure posted in stockroom (with phone numbers)	Spill response procedure posted	Insecticides past their expiration date	Containers for waste available and clearly marked	Thermometer in storeroom	Spill kits for storeroom	Fire extinguisher inside and outside	Leak-free floor and roof	Soap and water available	Antidotes to pesticides available nearby	Storeroom supervisors know signs of poisoning and location of nearest treatment facility	Pregnancy tests administered
Janga	No	Yes	Yes	Yes	Yes	Yes	N/A	Yes	Yes	No	Yes	Yes	N/A	Yes	No	No	No	Yes	Yes	Yes	No	No
Walewale	Yes	Yes	Yes	Yes	Yes	Yes	N/A	Yes	Yes	No	Yes	Yes	N/A	Yes	No	No	No	Yes	Yes	Yes	No	No
Kpasinkpe	No	Yes	Yes	Yes	Yes	Yes	N/A	Yes	Yes	No	Yes	Yes	N/A	Yes	No	No	No	Yes	Yes	Yes	No	No
Yizesi	No	Yes	No	Yes	Yes	Yes	N/A	Yes	Yes	No	Yes	Yes	N/A	Yes	No	No	No	Yes	Yes	Yes	No	No
Kubore	Yes	Yes	Yes	Yes	Yes	Yes	N/A	Yes	Yes	No	Yes	Yes	N/A	Yes	No	No	No	Yes	Yes	Yes	No	No
Langbinsi	Yes	Yes	Yes	Yes	Yes	Yes	N/A	Yes	Yes	No	Yes	No	N/A	Yes	No	No	No	Yes	Yes	Yes	No	No
Gambaga	Yes	Yes	Yes	Yes	Yes	Yes	N/A	Yes	Yes	No	Yes	Yes	N/A	Yes	No	No	No	Yes	Yes	Yes	No	No
Gbintiri	No	Yes	Yes	Yes	Yes	Yes	N/A	Yes	Yes	No	Yes	Yes	N/A	Yes	No	No	No	Yes	Yes	Yes	No	No
Nakpanduri	Yes	Yes	Yes	Yes	Yes	Yes	N/A	Yes	Yes	No	Yes	Yes	N/A	Yes	No	No	No	Yes	Yes	Yes	No	No
Nasuan	No	No	Yes	Yes	No	Yes	N/A	No	Yes	No	No	No	N/A	Yes	No	No	No	Yes	Yes	Yes	No	No
Yunyoo	Yes	Yes	Yes	Yes	Yes	Yes	N/A	No	Yes	No	No	No	N/A	Yes	No	No	No	Yes	Yes	Yes	No	No
Binde	Yes	Yes	Yes	Yes	Yes	Yes	N/A	No	Yes	No	No	No	N/A	Yes	No	No	No	Yes	Yes	Yes	No	No

Bunkpurugu	Operation site																			
Yes	Facility located an adequate distance from schools, homes, and water bodies																			
Yes	Double locks on pesticide storage																			
Yes	Facility guarded 24 hrs/day																			
Yes	Windows barred and screened																			
Yes	Soak pit fenced, gated, and locked																			
Yes	Danger signs with skull and crossbones																			
N/A	Pesticides properly labeled²¹																			
Yes	Material Safety Data Sheets (MSDS) readily available in storeroom																			
Yes	Adequate PPE in inventory for the number of operators expected																			
No	First aid kits for storeroom fully stocked																			
No	Emergency response procedure posted in stockroom (with phone numbers)																			
No	Spill response procedure posted																			
N/A	Insecticides past their expiration date																			
Yes	Containers for waste available and clearly marked																			
No	Thermometer in storeroom																			
No	Spill kits for storeroom																			
No	Fire extinguisher inside and outside																			
Yes	Leak-free floor and roof																			
Yes	Soap and water available																			
Yes	Antidotes to pesticides available nearby																			
No	Storeroom supervisors know signs of poisoning and location of nearest treatment facility																			
No	Pregnancy tests administered																			

TABLE 15: SUMMARY OF MID-SPRAY ENVIRONMENTAL INSPECTIONS- STORAGE FACILITY AND SOAK PITS

Operation Site	Date Inspection Performed																									
	(dd/mm/yr)	Have the spray operators eaten breakfast and had plenty of water to drink prior to donning PPE?	Are SOs in full PPE before boarding truck? (Helmet/visor, overalls, boots, gloves, mask, neck protection, flashlight)	Are any spray operators eating or drinking after donning PPE?	Do the Team Leaders do a casual physical inspection of SOs, i.e., look out for any obvious breathing problems, fatigue, weakness, alcohol intoxication, etc.?	Do operators fill spray pumps using the contents of drums 1, 3, and 5 and 7 from the previous day's progressive rinse?	Are barrels 1, 3, 5 and 7 empty when Spray Operators depart for the field?	Was this vehicle inspected and approved by ECO or authorized AIRS representative before contract signing?	Is the AIRS-issued certificate in the vehicle?	Does the driver and/or vehicle have the needed certification (driver's license, etc.) for transporting hazardous goods or numerous people?	Has the driver attended safety training?	Other than the pesticide sachets or bottles for the day's use, are any pesticides transported in the same vehicle with the operators?	Are food products, animal feed, or consumer goods transported in the same truck as pesticides?	Is there 1. a spill kit (sand, shovel, bucket) in the vehicle?	Is there 2. spill/emergency/accident response procedures in the vehicle?	Is there a fully-stocked first aid kit in the vehicle?	Do drivers have a cell telephone and appropriate PPE (boots, gloves, and filter mask) in case of a spill or accident?	If this vehicle transports pesticide, can the pesticides be adequately secured and tied down in the vehicle?	Does the vehicle have a fire extinguisher?	If this vehicle transports operators, does the spray operator transport vehicle have seats and railings?	Are the operators properly seated in the transport vehicle with the pump secured between their legs?	Is the vehicle overcrowded?	Is there evidence of pesticide leakage in the trucks?	Have there been any incidents of pesticide exposure?	Have there been any vehicular accidents?	
Moglaa	02/05/14	Yes	Yes	No	Yes	Yes	Yes	Yes	Yes	Yes	Yes	No	No	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	No	No	No	No
Diare	23/04/14	Yes	Yes	No	Yes	Yes	Yes	Yes	Yes	Yes	Yes	No	No	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	No	No	No	No
Walewale	28/05/14	Yes	Yes	No	Yes	Yes	Yes	Yes	Yes	Yes	Yes	No	No	Yes	Yes	No	Yes	Yes	Yes	Yes	Yes	Yes	No	No	No	No
Kubore	22/04/14	Yes	Yes	No	Yes	Yes	Yes	Yes	Yes	Yes	Yes	No	No	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	No	No	No	No
Langbinsi	29/05/14	Yes	Yes	No	Yes	Yes	Yes	Yes	Yes	Yes	Yes	No	No	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	No	No	No	No
Gambaga	27/04/14	Yes	Yes	No	Yes	Yes	Yes	Yes	Yes	Yes	Yes	No	No	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	No	No	No	No
Nakpanduri	30/04/14	Yes	Yes	No	Yes	Yes	Yes	Yes	Yes	Yes	Yes	No	No	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	No	No	No	No
Nasuan	04/05/14	Yes	Yes	No	Yes	Yes	Yes	Yes	Yes	Yes	Yes	No	No	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	No	No	No	No

Yunyoo	05/05/14	Yes	Yes	No	Yes	No	No	Yes	No	No	No	No														
Binde	01/05/14	Yes	Yes	No	Yes	No	No	Yes	No	No	No	No														

TABLE 16: SUMMARY OF MID-SPRAY ENVIRONMENTAL INSPECTIONS- HOUSEHOLD PREPARATION BEFORE IRS

Operation Site	Date of Inspection	Ask resident if they were informed in advance about the spray activities.	Have all personal belongings, food items, animals/sick persons been removed from the structure?	Have all items that cannot be removed been properly covered with plastic sheet?	Was the food removed before spraying?	Were the household items that are normally stored on the porches, roofs and exterior of the walls removed?	Have the residents been instructed not to enter for 2 hours, and then open windows and door to air out for 30 minutes before moving back in?	Have residents been informed to wash itchy skin, and to go to a health clinic if they don't feel well after their house has been sprayed?	Are all animals kept outside the structure during spraying and for 2.5 hrs. afterward?	If there are people (sick, elderly, babies) that cannot be moved, is this household being sprayed?	Have the residents been told to sweep up dead mosquitoes and deposit them in latrine pit and not to allow children or animal inside until this has been completed?	Are the residents told not to plaster, paint or clean the sprayed surfaces?	Are there households observed that are refusing IRS?	Are the households satisfied with the IRS?
	(dd/mm/yy)													
Langbinsi	15/04/14	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	No	Yes	Yes	Yes	Yes
Gbintiri	16/04/14	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	No	Yes	Yes	No	Yes
Janga	18/04/14	Yes	Yes	Yes	N/A	Yes	Yes	Yes	Yes	No	Yes	Yes	Yes	Yes
Moglaa	20/04/14	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	No	Yes	Yes	No	Yes
Zoggu	21/04/14	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	No	Yes	Yes	No	Yes
Kubore	22/04/14	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	No	Yes	Yes	No	Yes
Diare	23/04/14	Yes	Yes	Yes	No	Yes	Yes	Yes	Yes	No	Yes	Yes	Yes	Yes
Walewale	25/04/14	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	No	Yes	Yes	No	Yes
Gambaga	27/04/14	Yes	Yes	Yes	Yes	N/A	Yes	No	Yes	No	Yes	Yes	Yes	Yes
Nakpanduri	29/04/14	Yes	Yes	Yes	N/A	Yes	Yes	No	Yes	No	Yes	No	Yes	Yes
Binde	30/04/14	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	No	Yes	Yes	No	Yes
Nasuan site	04/05/14	Yes	Yes	Yes	N/A	Yes	Yes	Yes	Yes	No	Yes	Yes	No	Yes

Yunyoo	05/05/14	Yes	No	Yes	Yes	No	Yes								
Bunkpurugu	06/05/14	Yes	No	Yes	Yes	No	Yes								
Gambaga	14/05/14	Yes	Yes	Yes	N/A	Yes	Yes	Yes	Yes	Yes	No	Yes	Yes	No	Yes
Walewale	26/05/14	Yes	Yes	Yes	N/A	Yes	Yes	Yes	Yes	Yes	No	Yes	Yes	No	Yes
Diare	27/05/14	Yes	No	Yes	Yes	No	Yes								
Walewale	28/05/14	Yes	Yes	Yes	N/A	Yes	Yes	Yes	Yes	Yes	No	Yes	Yes	No	Yes

TABLE 17: SUMMARY OF MID-SPRAY ENVIRONMENTAL INSPECTIONS- OBSERVATION OF SPRAY OPERATORS IN THE FIELD

Operation Site	Date of Inspection	Are SOs in full PPE?	Is mixing of the insecticide witnessed by the household resident?	Does the operator triple-rinse the bottle while preparing the pesticide in the tank?	Is the tank shaken to mix the contents before pressurizing?	or the Gozper pump pressurized until the safety valve begins releasing pressure and Does the operator service the pump before proceeding?	Are the spray operators spraying with the tip of the nozzle 45 cm away from the wall?	Are the spray operators maintaining the correct speed of application, i.e., covering 2 meters of vertical wall surface in 5 seconds?	Is there a 5 cm overlap with each successive swath?	Are SOs spraying all the recommended surfaces? (walls, eaves, inside of doors, ceiling)	outside of doors, glass, inside of cupboards, wallpaper, food granaries, curtains, latrines, Is the pump re-pressurized in the Hudson tank pressure falls below 35 psi, or the Gozper automatically shuts off?	Are any of the SOs observed smoking, drinking or eating during the day? Have there been any reported accidents or complaints of pesticide exposure from residents or operators?	Are the Spray Operators accurately recording data?	Are Team Leaders using the Error Eliminator to check the accuracy of Spray Operators data?	Are Team Leaders using the Error Eliminator correctly?			
	(dd/mm/yy)																	
Langbinsi	15/04/14	Yes	Yes	Yes	Yes	Yes	N/A	Yes	Yes	Yes	Yes	No	Yes	No	No	Yes	Yes	Yes
Gbintiri	16/04/14	Yes	Yes	Yes	Yes	Yes	N/A	Yes	Yes	Yes	Yes	No	Yes	No	No	Yes	Yes	Yes
Janga	18/04/14	Yes	Yes	Yes	Yes	Yes	N/A	Yes	Yes	Yes	Yes	No	Yes	No	No	Yes	Yes	Yes
Moglaa	20/04/14	Yes	Yes	Yes	Yes	Yes	N/A	Yes	Yes	Yes	Yes	No	Yes	No	No	Yes	Yes	Yes
Zoggu	21/04/14	Yes	Yes	Yes	Yes	Yes	N/A	Yes	Yes	Yes	Yes	No	Yes	No	No	Yes	Yes	Yes
Kubore	22/04/14	Yes	Yes	Yes	Yes	Yes	N/A	Yes	Yes	Yes	Yes	No	Yes	No	No	Yes	Yes	Yes
Diare	23/04/14	Yes	Yes	Yes	Yes	Yes	N/A	Yes	Yes	Yes	Yes	No	Yes	No	No	Yes	Yes	Yes
Walewale	25/04/14	No*	Yes	Yes	Yes	Yes	N/A	Yes	Yes	Yes	Yes	No	Yes	No	No	Yes	Yes	Yes
Gambaga	27/04/14	Yes	Yes	Yes	Yes	Yes	N/A	Yes	Yes	Yes	Yes	No	Yes	No	No	Yes	Yes	Yes
Nakpanduri	29/04/14	Yes	Yes	Yes	Yes	Yes	N/A	Yes	Yes	Yes	Yes	No	Yes	No	No	Yes	Yes	Yes
Binde	30/04/14	Yes	Yes	Yes	Yes	Yes	N/A	Yes	Yes	Yes	Yes	No	Yes	No	No	Yes	Yes	Yes
Nasuan site	04/05/14	Yes	Yes	Yes	Yes	Yes	N/A	Yes	Yes	Yes	Yes	No	Yes	No	No	Yes	Yes	Yes
Yunyoo	05/05/14	No	Yes	Yes	Yes	Yes	N/A	Yes	Yes	Yes	Yes	No	Yes	No	No	Yes	Yes	Yes
Bunkpurugu	06/05/14	Yes	Yes	Yes	Yes	Yes	N/A	Yes	Yes	Yes	Yes	No	Yes	No	No	Yes	Yes	Yes
Gambaga	14/05/14	Yes	Yes	Yes	Yes	Yes	N/A	Yes	Yes	Yes	Yes	No	Yes	No	No	Yes	No*	N/A
Walewale	26/05/14	Yes	Yes	Yes	Yes	Yes	N/A	Yes	Yes	Yes	Yes	No	Yes	No	No	Yes	Yes	Yes
Diare	27/05/14	Yes	Yes	Yes	Yes	Yes	N/A	Yes	Yes	Yes	Yes	No	Yes	No	No	Yes	Na	N/A
Walewale	28/05/14	Yes	Yes	Yes	Yes	Yes	N/A	Yes	Yes	Yes	Yes	No	Yes	No	No	Yes	Na	N/A

* Both of these incidents were isolated and corrective measures were taken immediately.

TABLE 19: SUMMARY OF POST-SEASON ENVIRONMENTAL COMPLIANCE ASSESSMENTS- INSPECTION OF STORE AFTER COLLECTION OF LOGISTICS TO THE DISTRICT STORES

Operation Site	Date Inspection Performed	Have all the IRS items, signs, insecticides and wastes been removed from this store?	Has the pesticide storage area been washed with soap and water?	Is the soak pit covered and the gates locked?	Are the soak pit and its surroundings left clean?	Was the working relationship between the IRS team and the owners of the store good?	Would you recommend re-using this store next year?
	(dd/mm/yr)						
Moglaa	24/06/14	No	No	Yes	Yes	Yes	Yes
Zoggu	24/06/14	Yes	Yes	Yes	Yes	Yes	Yes
Diare	24/06/14	Yes	Yes	Yes	Yes	Yes	Yes
Janga	12/06/14	Yes	Yes	Yes	Yes	Yes	Yes
Walewale	16/06/14	Yes	Yes	Yes	Yes	Yes	No
Kpasinkpe	15/06/14	Yes	Yes	Yes	Yes	Yes	Yes
Yizesi	16/06/14	Yes	Yes	Yes	Yes	Yes	Yes
Kubore	16/06/14	Yes	Yes	Yes	Yes	Yes	Yes
Langbinsi	15/06/14	Yes	Yes	Yes	Yes	Yes	Yes
Gambaga	15/06/14	No	No	Yes	Yes	Yes	Yes
Gbintiri	19/06/14	Yes	Yes	Yes	Yes	Yes	Yes
Nakpanduri	23/06/14	Yes	Yes	Yes	Yes	Yes	Yes
Nasuan	19/06/14	Yes	Yes	Yes	Yes	Yes	Yes
Yunyoo	19/06/14	Yes	Yes	Yes	Yes	Yes	Yes
Binde	23/06/14	Yes	Yes	Yes	Yes	Yes	Yes
Bunkpurugu	23/06/14	Yes	Yes	Yes	Yes	Yes	Yes

ANNEX C. GHANA MONITORING AND EVALUATION

Africa IRS Project
GHANA Monitoring and Evaluation Plan Indicator Matrix
UPDATED: July 26, 2014

Performance Indicator	Indicator Definition	Project Year(s) Reporting	Data Source(s) and Reporting Frequency	Disaggregate	PMI/AIRS Indicator	Annual Targets and Results					
						Year 1		Year 2		Year 3	
						Target	Results	Target	Results	Target	Results

Component I: Establish cost-effective supply chain mechanisms including procurement, distribution and storage of IRS-related commodities and execute all aspects of logistical plans for IRS-related activities.

I.1 Procurement

I.1.1 Number and percentage of international insecticide procurement orders delivered in country, at port of entry, at least 30 days prior to the start of spray operations	<p>[<i>Numerator</i>: Number of international insecticide procurements delivered in country, at port of entry, at least 30 days prior to the start of spray operations]</p> <p>[<i>Denominator</i>: Total number of international insecticide procurements]</p> <p><i>Calculation</i>: [Numerator ÷ Denominator] x 100</p>	Y1, Y2, Y3	<p><i>Data source</i>: Project records – ex: international procurement documents, air way bills, commercial Invoices</p> <p><i>Reporting frequency</i>: Each spray season (annual/ semi-annual)</p>	By Spray Campaign	AIRS	1 PO (Actellic); 100%	Round 1: 0; 0% (insecticide delivery was delayed due to manufacturer, resulting in Actellic district spray campaign being delayed)	#TBD; 100%	1 (PO; Actellic CS); 100%	1; 100%	1 (PO; Actellic CS); 100%
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Performance Indicator	Indicator Definition	Project Year(s) Reporting	Data Source(s) and Reporting Frequency	Disaggregate	PMI/ AIRS Indicator	Annual Targets and Results					
						Year 1		Year 2		Year 3	
						Target	Results	Target	Results	Target	Results
							Round 2: N.A. ²²				
1.1.2 Number and percentage of international procurement orders (POs) for equipment, including PPE, received at port of entry, 30 days prior to start of spray operations.	<p>[Numerator: Number of international procurements for equipment, including PPE, at port of entry, 30 days prior to start of spray operations]</p> <p>[Denominator: Total number of international procurements for equipment, including PPE.]</p> <p>Calculation: $[\text{Numerator} \div \text{Denominator}] \times 100$</p>	Y1, Y2, Y3	<p>Data source: Project records – ex: international procurement documents, air way bills, commercial Invoices</p> <p>Reporting frequency: Each spray season (annual/ semi-annual)</p>	By Spray Campaign	AIRS	6 POs; 85%	3 of 6 POs were received 30 days prior to start of spray operations; 50%	11, 100%	13 of 17 POs were received 30 days prior to start of spray operations ; 76.5%	7, 100%	7 of 7 were received 30 days prior to start of spray operations; 100%

²² Insecticide (Fendona) used in round 2 was already in stock from 2011 procurement.

Performance Indicator	Indicator Definition	Project Year(s) Reporting	Data Source(s) and Reporting Frequency	Disaggregate	PMI/AIRS Indicator	Annual Targets and Results					
						Year 1		Year 2		Year 3	
						Target	Results	Target	Results	Target	Results
I.1.3 Number and percentage of local PPE procurement orders that are delivered to the regional warehouse 14 days before the start of spray operations	<p>[[<i>Numerator</i>: Number of local PPE procurements delivered to the regional warehouse 14 days before the start of spray operations]</p> <p>[<i>Denominator</i>: Total number of local PPE procurements.]</p> <p><i>Calculation</i>: [Numerator ÷ Denominator] x 100</p>	Y1, Y2, Y3	<p><i>Data source</i>: Project records-ex: delivery notes, goods receiving notes, inventory control cards</p> <p><i>Reporting frequency</i>: Each spray season (annual/semi-annual)</p>	By Spray Campaign	AIRS	#N.A.; 80%	N.A. ²³	1, 100% (For neck covers)	2 of 2 POs, 100% (1 for neck covers, 1 for aprons)	N/A	N/A
I.1.4 Successfully completed spray operations without an insecticide stock-out	Milestone: (Completed/Not Completed)	Y1, Y2, Y3	<p><i>Data source</i>: Project records</p> <p><i>Reporting frequency</i>: Each spray season (annual/semi-annual)</p>	By Spray Campaign	AIRS	Achieved	Achieved for both Rounds	Achieved	Achieved	Achieved	Achieved
I.2 In-country Logistics, Warehousing, and Training											
I.2.1 Number and percentage of logistics and warehouse managers trained in IRS supply chain management	<p>[<i>Numerator</i>: Total number of logistics and warehouse managers trained in IRS supply chain management using AIRS Project resources.]</p> <p>[<i>Denominator</i>: Total number of AIRS logistics and warehouse managers.]</p>	Y1, Y2, Y3	<p><i>Data source</i>: Routine training records</p> <p><i>Reporting frequency</i>: Semi-annually</p>	By Spray Campaign By Gender	PMI	9; 100%	9; 100%; (7 male, 2 female; 22.2% female)	19; 100% (4 logistics assistants and 15 store assistants)	21, 100%; (8 male, 13 female; 61.9% female)	21, 100%	21, 100%; (7 male, 14 female; 61.7% female)

²³ Due to previous management issues and lack of logistical oversight, this indicator is unable to be reported for Year 1.

Performance Indicator	Indicator Definition	Project Year(s) Reporting	Data Source(s) and Reporting Frequency	Disaggregate	PMI/AIRS Indicator	Annual Targets and Results					
						Year 1		Year 2		Year 3	
						Target	Results	Target	Results	Target	Results
	<i>Calculation: [Numerator ÷ Denominator] x 100</i>										
1.2.2 Number and percentage of district and operational site stores where physical inventories are verified by up-to-date stock records	<p><i>[Numerator: Number of district and operational site stores where physical inventories are verified by up-to-date stock records]</i></p> <p><i>[Denominator: Total number of district and operational site stores audited.]</i></p> <p><i>Calculation: [Numerator ÷ Denominator] x 100</i></p> <p><i>(See PIRS for details on sample size for operational audits)</i></p>	Y2, Y3	<p><i>Data source: Project records-inventory audit reports</i></p> <p><i>Reporting frequency: Each spray season (annual/semi-annual)</i></p>	By Spray Campaign	AIRS	N.A.	N.A.	13, 85%	16, 100%	16, , 100%	16, 100%
1.2.3 Submit up-to-date inventory records to AIRS Home Office 30 days after the end of each spray campaign	Milestone: (Completed/Not Completed)	Y2, Y3	<p><i>Data source: Project records</i></p> <p><i>Reporting frequency: Each spray season (annual/semi-annual)</i></p>	By Spray Campaign	AIRS	N.A.	N.A	Completed	Completed	Completed	Completed

Component 2: Implement safe and high-quality IRS programs and provide operational management support

2.1 Planning and Design of IRS Programs

Performance Indicator	Indicator Definition	Project Year(s) Reporting	Data Source(s) and Reporting Frequency	Disaggregate	PMI/ AIRS Indicator	Annual Targets and Results					
						Year 1		Year 2		Year 3	
						Target	Results	Target	Results	Target	Results
2.1.1 Annual IRS country work plan developed and submitted on time	Milestone: (Completed/Not Completed)	Y1, Y2, Y3	Data source: Project records Reporting frequency: Annually		AIRS	Completed	Completed	Completed	Completed	Completed	Completed
2.2 Support of Safety and Health Best Practices and Compliance with USAID and Host Country Environmental Regulations											
2.2.1 SEA/letter report submitted on time ²⁴	Milestone: (Completed/Not Completed)	Y1, Y2, Y3	Data source: Project records – submitted SEAs/ letter reports Reporting frequency: Each spray campaign	By Spray Campaign	AIRS	Completed	Completed	Completed	Completed	Completed	Completed
2.2.2 Number and percentage of soak pits and warehouses/ storerooms inspected and approved prior to spraying	[Numerator: Number of soak pits and/or storehouses inspected and certified by environmental officer] [Denominator: Total number of project soak pits and/or storehouses] Calculation: $[\text{Numerator} \div \text{Denominator}] \times 100$	Y1, Y2, Y3	Data source: Project records – Reports submitted by environmental compliance officer Reporting frequency: Each spray season	By Spray Campaign By soak pits and warehouses/storerooms	AIRS	31 soakpits; 31 warehouses; 100%	Round 1: 31 soakpits; 31 warehouses; 100% Round 2: 4 soakpits; 4 warehouses; 100%	15 soak pits; 15 warehouses; 100%	16 soakpits; 16 warehouses; 100%	16 soakpits; 16 warehouses; 100%	16 soakpits; 16 warehouses; 100%
2.2.3 Number of government environmental and health officers trained in IRS environmental compliance	Total number of government environmental and health officers trained in IRS environmental compliance using AIRS Project resources	Y1, Y2, Y3	Data source: Project training reports Reporting frequency: Semi-annually	By Spray Campaign By Gender	AIRS	18 ²⁵	18 (18 male, 0 female; 0% female)	12	10 (10 male, 0 female; 0% female)	10	10 ²⁶ (10 male, 0 female; 0% female)
2.2.4 Number of spray personnel trained in	Total number of spray personnel who attend a training	Y1, Y2, Y3	Data source: Project records – Training reports	By Spray Campaign	AIRS	720	Round 1: 899 (754 males,	330	490 (371 males, 119	550	731 (527

²⁴ In Year 1, SEAs were due 30 days prior to the commencement of spraying and letter reports were to be submitted 14 days prior to the commencement of spraying. In Year 2 and Year 3, due dates agreed upon with Washington-PMI will be noted in each country-specific Monitoring and Evaluation Plan to assess indicator 2.2.1.

²⁵ Training of government environmental and health officers in IRS environmental compliance occurred as an annual event in 2012, rather than per spray campaign.

²⁶ This figure includes: 5 District Disease Control Officers, 4 District Environmental Health Officers and 1 District Health Information Officer.

Performance Indicator	Indicator Definition	Project Year(s) Reporting	Data Source(s) and Reporting Frequency	Disaggregate	PMI/ AIRS Indicator	Annual Targets and Results					
						Year 1		Year 2		Year 3	
						Target	Results	Target	Results	Target	Results
environmental compliance and personal safety standards in IRS implementation	in environmental compliance and personal safety standards in IRS implementation using AIRS Project resources, includes all staff who received environmental compliance training - spray operators, team leaders, washpersons, storekeepers, etc.		Reporting frequency: Each spray season	By Gender			145 female)		female; 24% female)		male, 204 female; 27.9% female) ²⁷
2.2.5 Number of health workers receiving insecticide poisoning case management training	Total number of clinical personnel trained in insecticide poisoning case management using AIRS Project resources	Y2, Y3	Data source: Project records – Training reports Reporting frequency: Each spray season	By Spray Campaign By Gender	AIRS	100 ²⁸	93, (62 males, 31 females; 33.3% female)	50	46, (32 males, 14 females; 30.4% female)	50	47, (36 males, 11 females; 23.4% female)
2.2.6 Number of adverse reactions to pesticide exposure documented	Total number of incidents of pesticide exposure reported that resulted in a referral for medical care	Y1, Y2, Y3	Data source: Incident report forms that are required for each incidence of pesticide exposure Reporting frequency: Each spray season	By Spray Campaign By residential/occupational exposure	AIRS	0	Round 1: 0 Round 2: 0	0	0	0	0
2.2.7. Number of vehicular accidents reported	Total number of vehicular accidents reported	Y1, Y2, Y3	Data source: Vehicular incident report forms that are required for each accident Reporting frequency: Each spray season	By Spray Campaign	AIRS	0	Round 1: 0 Round 2: 0	0	4 (1 in West Mamprusi, 2 in Savelugu Nanton, 1 in Bunkpurugu Yunyoo)	0	0

²⁷ 634 SOPs (448 male, 186 female) + 97 TOT Trainees (79 male, 18 female)

²⁸ In Ghana, health worker training occurs once per year, rather than per campaign.

Performance Indicator	Indicator Definition	Project Year(s) Reporting	Data Source(s) and Reporting Frequency	Disaggregation	PMI/AIRS Indicator	Annual Targets and Results					
						Year 1		Year 2		Year 3	
						Target	Results	Target	Results	Target	Results
2.3 Support Entomological Monitoring Activities and Insecticide Resistance Strategies											
2.3.1 Number of sentinel sites supported by the AIRS project	Total number of entomological sentinel sites supported by the AIRS project	Y1, Y2, Y3	Data source: Entomological reports Reporting frequency: Annually	By Spray Campaign	AIRS	<u>Round 1:</u> 13 (10 experimental and 3 control sites) <u>Round 2:</u> 2	<u>Round 1:</u> 13 <u>Round 2:</u> 2	13	13	13	13
2.3.2 Number and percentage of entomological monitoring sentinel sites measuring all five primary PMI entomological indicators	<i>[Numerator:</i> Number of entomological monitoring sites measuring all five primary PMI entomological indicators] <i>[Denominator:</i> Number of entomological monitoring sentinel sites] <i>Calculation:</i> [Numerator ÷ Denominator] x 100	Y1, Y2, Y3	Data source: Entomological reports <i>Reporting frequency:</i> Annually	By Spray Campaign	AIRS	<u>Round 1:</u> 13, 100%	<u>Round 1:</u> 13, 100%	13, 100%	13, 100%	13; 100%	13, 100%
2.3.3 Number and percentage of entomological monitoring sites measuring at least one secondary PMI indicator	<i>[Numerator:</i> Number of entomological monitoring sites measuring at least one secondary PMI indicator] <i>[Denominator:</i> Number of entomological monitoring sites] <i>Calculation:</i> [Numerator ÷ Denominator] x 100	Y1, Y2, Y3	Data source: Entomological reports Reporting frequency: Annually	By Spray Campaign	AIRS	<u>Round 1:</u> 13, 100% <u>Round 2:</u> 2; 100%	<u>Round 1:</u> 13, 100% <u>Round 2:</u> 2; 100%	13, 100%	13, 100%	13, 100%	13, 100%
2.3.4 Number and	<i>[Numerator:</i> Number of	Y1, Y2, Y3	Data source: Entomological	By Spray	AIRS	<u>Round 1:</u>	<u>Round 1:</u> 11, 100%	11, 100%	4 of 11 of	9, 100%	Ongoing

Performance Indicator	Indicator Definition	Project Year(s) Reporting	Data Source(s) and Reporting Frequency	Disaggregate	PMI/AIRS Indicator	Annual Targets and Results					
						Year 1		Year 2		Year 3	
						Target	Results	Target	Results	Target	Results
percentage of insecticide resistance testing sites that tested at least one insecticide from each of the four classes ²⁹ of insecticides recommended for malaria vector control	insecticide resistance testing sites that tested at least one insecticide from each of the four classes of insecticides recommended for malaria vector control. [Denominator: Number of insecticide resistance testing sites] Calculation: [Numerator ÷ Denominator] x 100		reports Reporting frequency: Annually	Campaign By Type of Insecticide		11, 100%	100% ³⁰		the total sites tested at least one insecticide from each the 4 classes, 27.2% ³¹		, to be completed by 31 st August
2.3.5 Number of wall bioassays conducted within 2 weeks of spraying to evaluate the quality of IRS	Total number of wall bioassay studies conducted in established sentinel sites within 2 weeks of spraying to evaluate quality of IRS spraying activities	Y1, Y2, Y3	Data source: Entomological reports Reporting frequency: Per spray campaign	By Spray Campaign	PMI	Round 1: 24 for Fendona; 8 for Actellic Round 2: 8 Fendona	Round 1: 40 for Fendona; 24 for Actellic Round 2: 8 Fendona	4	12 ³² (for Actelic)	24	32

²⁹ Organochlorines class (DDT), Organophosphates class (Malathion, Fenithrothion, Pirimiphos Methyl), Carbamates class (Propoxur, Bendiocarb), Pyrethroids class (Detamethrin, Alpha-cypermethrin)

³⁰ Organochlorines class: DDT(4%), 1 of 11; Carbamates class: Propoxur (0.1%), 4 of 11; Bendiocarb (0.1%), 7 of 11. Organophosphates class: Melathion(5%) 4 of 11; Fenithrothion (1%), 8 of 11; Pirimiphos methyl (20mg), 2 of 11. Pyrethroids class: Detamethrin(0.05%) 3 of 11; Alpha-cypermethrin (0.4%) 11 of 11 tested; Alpha-cypermethrin (12.5mg) 2 of 11.

³¹ Organochlorines class: DDT(4%), 4 of 11; Organophosphates class: Melathion(5%) 2 of 11; Fenithrothion (1%), 6 of 11; Pirimiphos methyl (0.25%) 8 of 11. Carbamates class: Propoxur (0.1%), 4 of 11; Bendiocarb (0.1%), 6 of 11; Pyrethroids class: Detamethrin (0.05%) 6 of 11; Alpha-cypermethrin (0.05%) 7 of 11 tested.

³² The tests were done in three communities (2 communities in Savelugu Nanton and 1 community from Bunkpurugu Yunyoo). In each community, the test was carried out in 4 houses/ compounds.

Performance Indicator	Indicator Definition	Project Year(s) Reporting	Data Source(s) and Reporting Frequency	Disaggregate	PMI/AIRS Indicator	Annual Targets and Results					
						Year 1		Year 2		Year 3	
						Target	Results	Target	Results	Target	Results
2.3.6 Number of wall bioassays conducted after the completion of spraying at every other month intervals to evaluate insecticide decay	Total number of wall bioassay studies conducted at bi-monthly intervals in established sentinel sites to evaluate the rate of insecticide decay on sprayed surfaces	Y1, Y2, Y3	Data source: Entomological reports Reporting frequency: <i>Per spray campaign</i>	By Spray Campaign	PMI	Perform bioassays at months 0,2,4,6; Fendona: 96 (8 houses tested at the 4 time periods) Actellic: 32 (8 houses tested at the 4 time periods)	Round 1: 40 Round 2: 16	48	196 ³³ ; 136 tests with Kisumu strain and 60 tests with wild <i>Anopheles</i> mosquitoes		88 (ongoing, expected to update in December)

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Wall bioassays using Kisumu strain				
Time	Month	Communities	Houses	Total Bioassays
0	Jul-13	6	4	24
1	Aug-13	6	4	24
2	Sep-13	6	4	24
3	Oct-13	6	4	24
4	Nov-13	6	4	24
5	Dec-13	4	4	16
TOTAL				136

Wall bioassays using Anopheles mosquitoes				
Time	Month	Communities	Houses	Total Bioassays
0	Jul-13	3	4	12
1	Aug-13	3	4	12
2	Sep-13	3	4	12
3	Oct-13	3	4	12
4	Nov-13	3	4	12
TOTAL				60

Performance Indicator	Indicator Definition	Project Year(s) Reporting	Data Source(s) and Reporting Frequency	Disaggregate	PMI/AIRS Indicator	Annual Targets and Results					
						Year 1		Year 2		Year 3	
						Target	Results	Target	Results	Target	Results
2.3.7 Number of vector susceptibility tests for different insecticides conducted in selected sentinel sites	Total number of vector susceptibility tests conducted to gauge the effectiveness of individual insecticides proposed for use in spray operations	Y1, Y2, Y3	Data source: Entomological reports Reporting frequency: Per spray campaign	By Type of Insecticide	PMI	16	42 ³⁴	42	47 ³⁵	42	7 ³⁶ (ongoing)
2.4.1 Number of radio spots, talk shows, and video shows aired	Total number of radio spots and talk shows aired in target spray districts to stress the safety and benefits of IRS, ensure successful spray coverage, timely vacating of premises and adherence to IRS safety precautions by community members	Y1, Y2, Y3	Data source: Project records- receipts and invoices of payment made for radio spots/ programs Reporting frequency: Semi-annually	By Spray Campaign	AIRS	N.A. ³⁷	<u>Round 1:</u> 450 radio spots/jingles; 24 interactive radio shows; 17 video shows	Radio spot jingles: 882 Talk shows:42 Video shows: 20	Radio spot jingles: 372 Talk shows:16 Video shows: 12	Radio spot jingles: 540 Talk shows:32 Video shows: 20	Radio spot jingles: 360 Talk shows: 20 Video shows: 46
2.4.2 Number of IRS print materials disseminated	Total number of IRS educational materials developed, printed and distributed to community members in target spray districts using AIRS Project resources	Y1, Y2, Y3	Data source: Project records Reporting frequency: Semi-annually	By Spray Campaign By Type of printed material and message(s)	AIRS	90,000	<u>Round 1:</u> 65,000 (42,000 Posters; 23,000 Brochures) <u>Round 2:</u> 1,857: (1,857	40,000 (30,000 posters, 10,000 brochures)	34,800 (25,000 posters and 9,800 brochures)	29,200 (23,000 posters and 6,200 brochures)	29,400 (21,400 Posters and 8,000 Brochures) ³⁸

³⁴ Alpha-cypermethrin: 13; Detamethrin: 4; Pirimiphos methyl: 2; Fenithrothion: 3; Malathion: 8, Propoxur: 4; Bendiocarb: 7; DDT: 1;

³⁵ Alpha-cypermethrin (0.05%): 7; Detamethrin (0.05%) : 6; Pirimiphos methyl (0.25%): 9; Fenithrothion (1%), 8; Malathion (5%): 2; Propoxur (0.1%): 5; Bendiocarb (0.1%): 6; DDT(4%): 4.

³⁶ Alpha-cypermethrin: 2; Etofenprox (0.5%):1; Permethrin (0.75%): 1; Pirimiphos methyl (0.25%): 3

³⁷ No specific target was set at the time of 2012 workplanning.

³⁸ 20,320 provided directly to households via house-to-house mobilization and 9,080 provided in public places like schools and markets.

Performance Indicator	Indicator Definition	Project Year(s) Reporting	Data Source(s) and Reporting Frequency	Disaggregate	PMI/AIRS Indicator	Annual Targets and Results					
						Year 1		Year 2		Year 3	
						Target	Results	Target	Results	Target	Results
							Posters; 0 Brochures)				
2.4.3 Number of people reached with IRS messages via door-to-door mobilization	Total number of adults reached with IRS message during pre-spray community, door-to-door mobilization	Y1, Y2, Y3	Data source: Mobilization Data Collection Forms Reporting frequency: Daily per mobilization conducted	By Spray Campaign By Gender	AIRS	486,207 (50% of target population 972,413)	Round 1: 346,382 (155,428 male, 190,954 female) Round 2: 17,172 (7,955 male, 9,217 female)	235,367	204,014 (93,698 male, 110,316 female)	284,030 ³⁹	208,027 (94,195 male, 113,832 female;)
2.5.1 Number of structures targeted for spraying ⁴⁰	Total number of structures found in targeted spray districts by Spray Operators	Y1, Y2, Y3	Data source: Daily Spray Operator Forms Reporting frequency: Daily per spray campaign	By Spray Campaign	PMI	Round 1: 383,018 ⁴¹ Round 2: 15,498	Round 1: 383,142 Round 2: 17,239	192,685	216,876	216,876	244,799
2.5.2 Number of structures sprayed with IRS ⁴²	Total number of structures in targeted spray districts where spraying was conducted	Y1, Y2, Y3	Data source: Daily Spray Operator Forms Reporting frequency: Daily per spray campaign	By Spray Campaign	PMI	Round 1: 344,716	Round 1: 355,278 Round 2: 16,354	173,416 (90% of 192,685)	197,655	195,188 (90% of 216,876)	205,230
2.5.3 Percentage of total structures targeted for	/Numerator: Total number of structures sprayed in targeted	Y1, Y2, Y3	Data source: Daily Spray Operator Forms	By Spray Campaign	PMI	90%	Round 1: 92.7%	90%	91.1%	90%	83.8%

³⁹ This figure is 50% of the targeted population. Targeted population is 568,059, 50% is 284,029.5.

⁴⁰ The yearly targets for this indicator are from the applicable workplan, in this way the variation in targeted spray areas from year-to-year can be taken into account. The yearly results are the number of structures found by Spray Operators during the spray campaign.

⁴¹ Given the 2012 AIRS Ghana Workplan did not provide a specific target, this figure is the number of structures found by Spray Operators during 2011 operations in the same districts targeted in 2012.

⁴² The target per year for this indicator is based on 90% of the number of structures to be targeted for spraying (indicator 2.5.1).

Performance Indicator	Indicator Definition	Project Year(s) Reporting	Data Source(s) and Reporting Frequency	Disaggregate	PMI/AIRS Indicator	Annual Targets and Results					
						Year 1		Year 2		Year 3	
						Target	Results	Target	Results	Target	Results
spraying that were sprayed with a residual insecticide (Spray Coverage)	districts] [Denominator: Total number of structures in targeted areas found by spray operators] Calculation: [Numerator ÷ Denominator] x 100		Reporting frequency: Daily per spray campaign				Round 2: 94.9%				
2.5.4 Number of people residing in structures sprayed (Number of people protected by IRS)	Total number of people residing in structures sprayed (Actual numbers are collected during spray operations; population estimates are not used.)	Y1, Y2, Y3	Data source: Daily Spray Operator Forms Reporting frequency: Daily per spray campaign	By Spray Campaign By Number of pregnant women By Number of children <5 years old	PMI	972,413 ⁴³	Round 1: 941,240 (22,704 pregnant women, 187,653 children under 5 years old) Round 2: 41,100 (710 pregnant women, 6,778 children under 5 years old)	470,733	534,060 (11,617 pregnant women, 102,115 children under 5 years old)	568,059 ⁴⁴	570,572 (12,538 pregnant women, 105,983 children under 5 years old)
Component 3: Provide ongoing monitoring and evaluation and quality control measures											
3.1 Submit Monitoring and Evaluation Plan (MEP) to PMI-GHANA	Milestone: (Completed/Not Completed)	Y1, Y2, Y3	Data source: Project records Reporting frequency: Semi-		AIRS	Completed	Completed	Completed		Completed	Completed

⁴³ Estimate of population to be protected from 2012 AIRS Ghana Workplan.

⁴⁴ This is the 2013 population protected (534,060) plus the population in unsprayed structures (33,999) in that same year.

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

Component 4:

Contribute to Global IRS Policy-Setting and Country-Level Policy Development of Evidence-Based IRS; Disseminate Experiences and Best Practices

4.1 Number of guidelines/checklists/tools related to IRS operations developed or refined with project support	Total number of implementation guidelines, process checklists and program tools related to IRS operations developed or refined using the technical and/or financial resources of the AIRS Project	Y1, Y2, Y3	Data source: Project records – Activity reports Reporting frequency: Semi-annually	By Guideline/checklist/tool	AIRS	N.A.		TBD	4 (Data Collection Verification form, Error Eliminator, Data Entry	TBD	⁴⁵
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⁴⁵ AIRS supported the MaVCOG to revise and print the IRS operations guidelines for Ghana.

Performance Indicator	Indicator Definition	Project Year(s) Reporting	Data Source(s) and Reporting Frequency	Disaggregate	PMI/AIRS Indicator	Annual Targets and Results					
						Year 1		Year 2		Year 3	
						Target	Results	Target	Results	Target	Results
									Verification form, Ghana Spray Operations Supervisor's Checklist)		
4.2 Number of articles/best practices documents published	Total number of articles or other best-practice documents that have been published in relevant journals or through PMI/USAID communications vehicles	Y2, Y3	Data source: Project records – Activity reports Reporting frequency: Semi-annually	By Spray Campaign By IRS Technical Area	AIRS	N.A.	² ⁴⁶	TBD	³ ⁴⁷	TBD	Ongoing

⁴⁶ 2 articles: “Ghana-Angola peer mentoring builds capacity of local staff” <http://www.africairs.net/2012/11/ghana-angola-peer-mentoring-builds-capacity-of-local-staff/> and “Community members: ‘We know [IRS] is working because we can smell it’” <http://www.africairs.net/2012/12/2757/>

⁴⁷ 2 videos: “Community Engagement is Key to Malaria Prevention,” <http://www.africairs.net/2013/09/video-community-engagement-is-the-key-to-malaria-prevention/> ; “Recycling gives insecticide bottles new use,” <http://www.africairs.net/2013/09/video-recycling-gives-insecticide-bottles-new-use/> . 1 article: “Ghana: A woman’s job means more than a paycheck,” <http://www.africairs.net/2013/06/ghana-a-womans-job-means-more-than-a-paycheck/>.

Performance Indicator	Indicator Definition	Project Year(s) Reporting	Data Source(s) and Reporting Frequency	Disaggregate	PMI/ AIRS Indicator	Annual Targets and Results					
						Year 1		Year 2		Year 3	
						Target	Results	Target	Results	Target	Results
4.3 Number of best practice presentations given at national/ regional/international workshops and conferences	Total number of project-related oral and poster presentations delivered in national, regional and/or international meetings related to IRS.	Y2, Y3	Data source: Project records – Activity reports Reporting frequency: Semi-annually	By IRS Technical Area	AIRS	N.A.	1 ⁴⁸	TBD	6 ⁴⁹	TBD	Ongoing

Component 5 (Cross-cutting): Capacity Building, Knowledge Transfer, Gender Inclusion

5.1.1 Number of people trained in IRS implementation ⁵⁰	Total number of personnel trained in IRS implementation using AIRS Project resources. This figure only includes spray personnel such as spray operators, team leaders,	Y1, Y2, Y3	Data source: Project records – Training reports Reporting frequency: Semi-annually	By Spray Campaign By Gender Percentage of	PMI	720	<u>Round 1:</u> 992 ⁵¹ ; (816 male, 176 female; 17.7%)	544	669; (523 male, 146 female; 21.8%)	711	750 (543 male, 207 female; 27.6%)

⁴⁸ AIRS Ghana – Country Lessons Presentation at AIRS Annual Conference on December 4, 2012, Tahiru Ahmed, AIRS Ghana Operations Manager.

⁴⁹ Four presentations made at the Malaria Vector Control Oversight Committee (MaVCOC). The aim of the presentations was to update the MaVCOC on the activities of the program. Q1, Q2 and Q4 presentations were by Sylvester Coleman while Q3 was presented by Ernest Fletcher on the following dates: Q1-7th March, 2013; Q2-13th June 2013; Q3-23rd August 2013; Q4-28th November 2013

Chief of Party, Peter Mumba, “Preparing an IRS Operations Budget,” Vector Control Working Group Presentation at West Africa Malaria Conference held from 12- 13th September 2013. The workshop was organized by GBHealth’s Corporate Alliance for Malaria in Africa (CAMA) program, in partnership with the Roll Back Malaria (RBM) Vector Control Working Group West Africa.

Presentation by Chief of Party, Peter Mumba on the Ghana AIRS program to the MOP team on 14th May 2013. The purpose of the presentation was to get more information needed to prepare a Malaria Operational Plan.

⁵⁰ This indicator is sometimes termed “Number of people trained with USG funds to deliver IRS.”

⁵¹ See Annex B, Table 4 for training details.

Performance Indicator	Indicator Definition	Project Year(s) Reporting	Data Source(s) and Reporting Frequency	Disaggregate	PMI/AIRS Indicator	Annual Targets and Results					
						Year 1		Year 2		Year 3	
						Target	Results	Target	Results	Target	Results
	supervisors, clinicians; it excludes data clerks, IEC mobilizers, drivers, washers, porters, pump technicians, security guards, etc.			Women Trained							female) 52
5.1.2 Number of people trained to deliver or support IRS in target districts	Total number of people trained using AIRS Project resources to implement/support elements of IRS in target districts. This figure includes all cadre that serve a role in IRS.	Y1, Y2, Y3	Data source: Project records – Training reports Reporting frequency: Semi-annually	By Spray Campaign By Gender By Role (e.g., spray operator, storekeeper) Percentage of women trained	AIRS	~2,010	Round 1: 1,458; (1,258 male, 200 female; 13.7% female) Round 2: 85 (69 males: 16 females: 18.8%)	2,442	1,681; (1,448 male, 233 female; 13.9% female)	1,617	1,657(1,357 male, 300 female; 18.1% female) 53
5.1.3 Number of personnel trained as IRS implementation trainers	Total number of personnel trained in Training of Trainers (TOT) for IRS delivery	Y1, Y2, Y3	Data source: Project records – Training reports Reporting frequency: Semi-annually	By Spray Campaign By Gender Percentage of women trained	AIRS	120	99 (95 male, 4 female; 4.0%)	164	133; (120 male, 13 female; 9.8%)	111	97 (79 male, 18 female; 18.7%)
5.1.4 Number of government environmental and/or health officials trained in IRS oversight	Total number of national and sub-national/district government environmental and/or health officials who are trained in oversight of IRS implementation using AIRS Project resources	Y1, Y2, Y3	Data source: Project records – Training reports Reporting frequency: Semi-annually	By Spray Campaign By Gender Percentage of Women	AIRS	N.A.	18 (18 males, 0 female; 0% female) - 9 Disease Control Officers, 9 District	8	10 (10 males, 0 female; 0% female) - 5 Disease Control Officers, 5	20	10 ⁵⁴ (10 male, 0 female; 0% female)

⁵² 97 TOT (79 Male, 18 female) + 634 SOPs (448 male, 186 female), 47 Medical treatment of Intoxication Cases (36 male, 11 female).

⁵³ See breakdown in Table 4: Number of People Trained in 2014 EOSR

⁵⁴ This figure includes: 5 District Disease Control Officers, 4 District Environmental Health Officers and 1 District Health Information Officer

Performance Indicator	Indicator Definition	Project Year(s) Reporting	Data Source(s) and Reporting Frequency	Disaggregate	PMI/ AIRS Indicator	Annual Targets and Results					
						Year 1		Year 2		Year 3	
						Target	Results	Target	Results	Target	Results
				Trained Type of government official (e.g. environmental/health)		Environmental Health Officers		District Environmental Health Officers			
5.1.5 AIRS conducted a capacity assessment	AIRS Ghana program conducted an assessment of IRS capacity among national and sub-national/district government health officials	Y1, Y2	Data source: Project records – Capacity assessment reports Reporting frequency: Semi-annually		AIRS	Completed	Pending	Completed	Completed	N/A Completed	N/A
5.1.6 Number of capacity-building MOUs signed by AIRS, NMCP and partners/ institutions	Total number of Memoranda of Understanding (MOU) on provision of local capacity building finalized and signed between AIRS, the National Malaria Control Program, and other local partners and institutions	Y1, Y2, Y3	Data source: Project records – MOUs Reporting frequency: Semi-annually	By Spray Campaign	AIRS	N.A.	N.A.	TBD	0	TBD	N.A.

ANNEX D. GHANA IRS CAPACITY BUILDING PLAN

I. INTRODUCTION

I.1 BACKGROUND

The Africa Indoor Residual Spraying (AIRS) project, implemented under the President's Malaria Initiative (PMI), conducted a capacity assessment in Ghana in 2013. The purpose of the assessment was to evaluate overall capability and capacity of host-government and independent local entities to carry out the technical, operational, monitoring, and management functions for implementing an indoor residual spraying (IRS) program.

Based on the results of the capacity assessment, AIRS Ghana, together with PMI and the NMCP, identified specific areas where the project can assist the NMCP to strengthen their capacities, in order to play an increasing role in IRS campaign implementation in the next and future spray operations.

I.2 RESULTS FROM THE CAPACITY ASSESSMENT

The AIRS Ghana project team and stakeholders assessed the IRS capacity in Ghana and the overall capacity is at 60 percent. Technical component scores ranged from 35 to 93 percent, with Procurement ranked lowest and Entomology ranked highest.

The following table shows the results for each technical area and cross-cutting area. The maximum possible score for each cross-cutting area is 4.

TABLE I. CAPACITY ASSESSMENT RESULTS

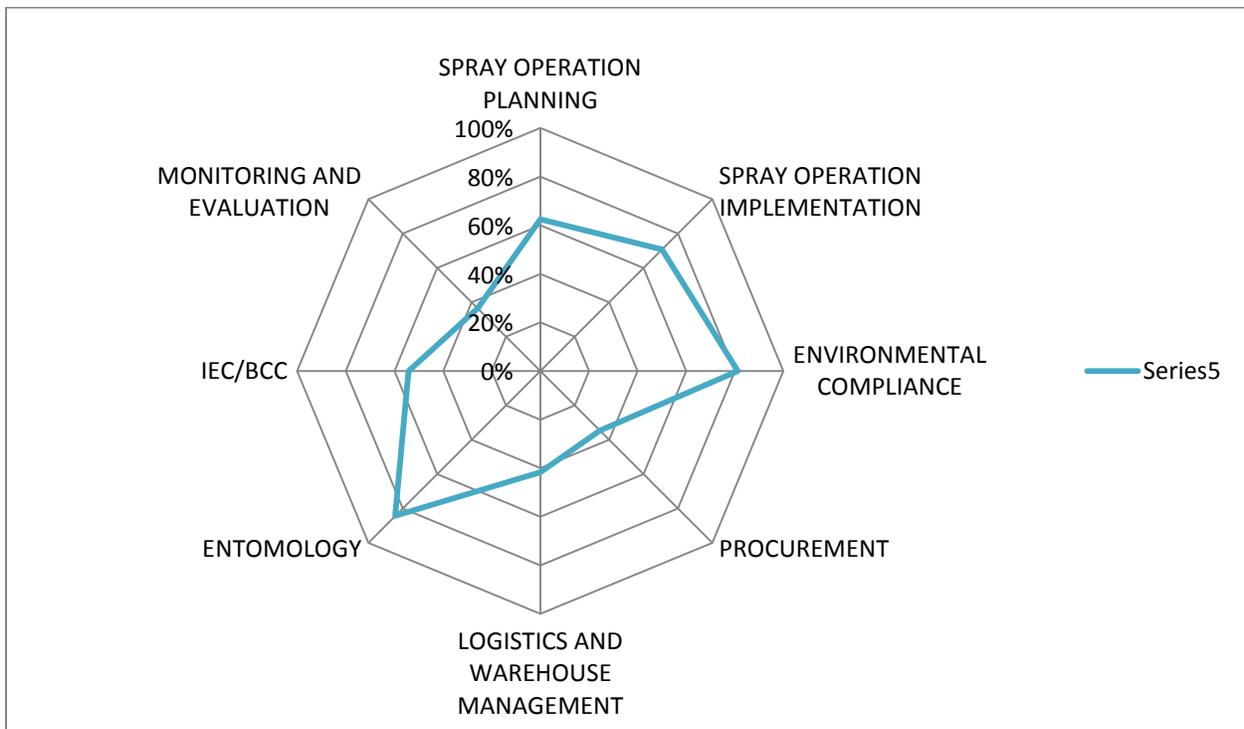
COMPONENT	CATEGORY	SCORE	PERCENT
1. Spray Operation Planning	1. Leadership	2.00	
	2. Policy and Strategy	3.00	
	3. Operating Systems (Technical)	3.00	
	4. Management Structures	3.00	
	5. Human Resources	2.00	
	6. Physical Resources	2.00	
	Total Component Score	15.00	63%
2. Spray Operation Implementation	1. Leadership	3.00	
	2. Policy and Strategy	4.00	

	3. Operating Systems (Technical)	2.00	
	4. Management Structures	2.00	
	5. Human Resources	3.00	
	6. Physical Resources	3.00	
	Total Component Score	17.00	71%
3. Environmental Compliance	1. Leadership	4.00	
	2. Policy and Strategy	3.00	
	3. Operating Systems (Technical)	3.00	
	4. Management Structures	2.00	
	5. Human Resources	3.00	
	6. Physical Resources	3.00	
	Total Component Score	18.00	75%
4. Procurement	1. Leadership	2.00	
	2. Policy and Strategy	1.00	
	3. Operating Systems (Technical)	1.00	
	4. Management Structures	1.00	
	5. Human Resources	1.00	
	6. Physical Resources	2.33	
	Total Component Score	8.33	35%
5. Logistics and Warehouse Management	1. Leadership	2.00	
	2. Policy and Strategy	1.00	
	3. Operating Systems (Technical)	1.00	
	4. Management Structures	1.00	
	5. Human Resources	2.00	
	6. Physical Resources	3.00	
	Total Component Score	10.00	42%
6. Entomology	1. Leadership	4.00	
	2. Policy and Strategy	4.00	
	3. Operating Systems (Technical)	4.00	
	4. Management Structures	3.50	
	5. Human Resources	3.50	
	6. Physical Resources	3.33	
	Total Component Score	22.33	93%
7. IEC / BCC	1. Leadership	2.00	
	2. Policy and Strategy	2.00	
	3. Operating Systems (Technical)	3.00	
	4. Management Structures	2.00	
	5. Human Resources	3.00	
	6. Physical Resources	3.00	

	Total Component Score	15.00	63%
8. Monitoring and Evaluation	1. Leadership	1.00	
	2. Policy and Strategy	1.00	
	3. Operating Systems (Technical)	1.00	
	4. Management Structures	1.25	
	5. Human Resources	2.50	
	6. Physical Resources	2.00	
	Total Component Score	8.75	36%
	GRAND TOTAL OF ALL COMPONENT SCORES AND MEAN %	19.07	60%

The percentages derived for each technical component are displayed below in Figure 1.

FIGURE 1: RESULTS OF GHANA COUNTRY IRS CAPACITY ASSESSMENT



2. CAPACITY PLAN

AIRS Ghana jointly with NMCP and PMI reviewed the results of the capacity assessment and discussed areas in which the project can support the NMCP to enhance in-country IRS competency in 2014. The three areas chosen to provide capacity building assistance are Spray Operations Planning and Implementation, Monitoring and Evaluation, and Entomology.

Area #1: Spray Operations Planning and Implementation

Although IRS has been implemented in Ghana by Anglo Gold Ashanti for 10 years and the President's Malaria Initiative (PMI) for over six years, very little capacity exists at the district level to plan and implements IRS in the high malaria burden districts. For sustainability of IRS, it is important that district health management teams are involved in the planning and implementation of IRS. Since the majority of IRS planning is district focused, it is important to build capacity at the district level to equip district health directorate staff with the needed skills. Currently, external help is needed to plan and implement activities for a spray round. This category was chosen because some local structures exist for project implementation and they can be strengthened in the area of IRS to build the needed capacity for IRS planning and implementation.

Objective: Build strong district level capacity to guide IRS planning and implementation.

Area #2: Monitoring & Evaluation

Monitoring and evaluation forms an integral part of an IRS program. IRS planning and implementation relies on good data for decision making. It is therefore important to have a good M&E system in place to manage data and generate high quality reports for decision making. Currently, there is no IRS M&E system in place except what is provided by donor funding. It is therefore important to ensure the skills needed to manage such systems are transferred to district level staff who already have similar job roles. This will improve decision making by the NMCP.

Objective: Develop database, tools and guidelines for IRS data management and strengthen NMCP staff's knowledge and skills in IRS data management.

Area #3: Entomology

Very little capacity exists, especially at the district level, for entomological monitoring and supervision. PMI has been supporting Noguchi and the NMCP in the monitoring of insecticide resistance in all 10 regions of Ghana. In total, 20 sites have been established to gather data for national insecticide resistance management. A lot of success has been achieved and it will be necessary to continue this support and perfect it at all levels in the future for successful insecticide resistance management and entomological data gathering and analysis.

Objective: To build and strengthen district level capacity for supervision and monitoring of entomological activities.

In order to achieve the objectives listed above, the following activities will be completed in 2014. Each of the activities will be organized and led by AIRS.

IRS Component	Sub component	Capacity Gap/ Challenge	Capacity Building Activity	Parties Involved	Activity Timeline
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Spray Operations Planning and Implementation	Human Resources & Training	Shortage of experienced personnel at regional and district level to plan and implement IRS	Conduct a general orientation on IRS for Malaria Focal Persons in the Northern Zone based on developed SOP	AIRS, NMCP	3rd Week of August 2014
Monitoring and Evaluation	Operating Systems	Database, collection tools, and guidelines for IRS data management do not exist	Develop M&E database and tools for IRS data management and provide a training package for 2 NMCP staff and 2 staff from the three selected regions based on the developed tools	GHS, NMCP, AIRS	August 2014
Entomology	1. Operating Systems: Improve national Insecticide Resistance Management 2. Human Resources & Training: Improve district ento capacity to monitor and supervise	1. Limited capacity at national level to gather and analyze entomological data for decision making. 2. Limited capacity at district level for supervision of entomological monitoring and data analysis.	1. Facilitate and provide logistical support for Noguchi and NMCP in the monitoring of insecticide resistance in all 20 sites. 2. Conduct training for district level staff to build entomological monitoring skills at the district level.	MOH/ NMCP, AIRS	July 2014