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Indoor Residual Spraying (IRS 2) Task Order Four

ANGOLA END OF SPRAY REPORT
SPRAY CAMPAIGN: OCTOBER 2 – NOVEMBER 19, 2013

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TABLE OF CONTENTS

Abbreviations	vii
Executive Summary	viii
1. Introduction	1
2. Pre-Spray Activities	3
2.1 Site Selection	3
2.2 Insecticide Selection.....	4
2.3 Micro-Planning	4
2.4 Environmental and Logistics Assessment.....	4
2.5 Human Resources Requirements.....	5
2.6 Training	5
3. Advocacy, Communication, and Mobilization	9
3.1 Introduction	9
3.2 Pre-Spray Meetings and Planning	9
3.3 Mobilization and Enumeration	10
4. Spray Activities	12
4.1 Introduction	12
4.2 Field Supervision	13
4.3 Data Reporting	13
4.4 Logistics and Stock Management.....	13
4.5 Spray Campaign Transportation	14
4.6 Safety and Environmental Compliance.....	15
4.7 Adverse Reactions and Accidents	16
5. Post-Spray Activities	17
5.1 Evaluation Meetings	17
5.2 Post-Spray Environmental Assessment.....	17
5.3 Waste Management	18
5.4 Inventory	20
6. Entomology	22
6.1 Insectary.....	22
6.2 Insecticide Resistance.....	22
6.3 Monitoring Vector Density, Distribution, Seasonality and Behavior	25
6.3.1 CDC Light Trap Collection	25
6.3.2 Pyrethrum Spray Catch (PSC).....	25
6.4 Quality Assurance & Decay Monitoring.....	28
7. Monitoring & Evaluation	31
7.1 Key Objectives and Approach	31
7.2 Data Collection and Management.....	31

7.3 Data Center Operations and Data Entry	31
7.4 Data Quality Assurance and Quality Control.....	32
7.5 Database Quality Control and Data Cleaning	32
7.6 2013 CAMPAIGN RESULTS	33
7.7 Insecticide Use and Spray Operator Performance	35
7.8 E-mobile Data Collection and Data Verification Pilot.....	36
7.8.1 Training.....	36
7.8.2 Smartphone Set-up and Inventory Management.....	36
7.8.3 Data Collection and Data Verification	37
7.8.4 Data Cleaning and Reporting.....	37
7.8.5 Lessons Learned and Recommendations.....	38
8. Capacity-Building	40
9. Challenges, Lessons Learned, and Recommendations.....	41
9.1 Challenges	41
9.2 Lessons Learned and Recommendations	41
ANNEX 1: Use of Supervisory Tools	44
ANNEX 2: ANGOLA Monitoring and Evaluation Plan Indicator Matrix	45

LIST OF TABLES

Table 1: Provinces and Population Protected since 2005	1
Table 2: Types of Training Categories.....	7
Table 3: People Trained in IRS Implementation.....	8
Table 4: Summary of AIRS Angola 2013 Mobilization Campaign.....	11
Table 5: IRS Communication Materials	11
Table 6: IRS Advocacy Activities.....	12
Table 7: Length of the Spray Campaign, by Operational Days	12
Table 8: Distribution of Vehicles, by Province	15
Table 9: Solid Waste Inventory.....	18
Table 10: Post-Spray Campaign Program Inventory.....	20
Table 11: Male and Female Proportions of the <i>Anopheles</i> Mosquitoes Tested in Huambo and Huila Provinces	23
Table 12: Insecticide Susceptibility Testing Results, Huambo and Huila Provinces.....	24
Table 13: List of Sentinel Sites	
Table 14: Summary of Mosquitoes per Species, Collected by CDC Light Traps, May, October – December 2013.....	27
Table 16: Cone Bioassay Testing from October (T0) – December 2013 (T2).....	29
Table 17: Summary of Spray Results: 2013 AIRS Angola campaign.....	33
Table 18: Insecticide Sachet Stock.....	35
Table 19: Spray Operator Performance and Insecticide Use.....	35

LIST OF FIGURES

Figure 1: Certificate of Incineration of 2013 Spray Campaign Solid Waste	19
Figure 2: Insecticide Susceptibility Test Results, Huambo and Huila Provinces	24
Figure 3: Cone Bioassay Test Results of <i>An. gambiae</i> s.l., by Number of Mosquitoes Exposed and Number Dead after 30-Minute Exposure and 24- hr. Holding Period at T0, T1 and T2.....	30
Figure 4: A/ Entomology technician introducing <i>Anopheles</i> mosquitoes into the WHO cone using aspirator B/ Technicians waiting for the 30-minute exposure period to remove the exposed mosquitoes C/ Transferring mosquitoes into holding paper cups	30
Figure 5: AIRS Angola Daily Performance Tracker	35

ABBREVIATIONS

AIRS	Africa Indoor Residual Spraying
BAI	<i>Banco Angolano de Investimentos</i>
CoP	Chief of Party
CDC	Centers for Disease Control
CTC	Center for Technology and Communications
DDT	Dichloro-diphenyl-trichloroethane
DPS/PDH	Direcção Provincial da Saúde/Provincial Directorate of Health
DEC	Data Entry Clerk
ECO	Environmental Compliance Officer
F&A	Finance & Administration
IEC	Information, Education and Communication
IQK	Insecticide Qualification Kits
IRS	Indoor Residual Spraying
ITN	Insecticide-Treated Net
M&E	Monitoring and Evaluation
M&EM	M&E Manager
MoH	Ministry of Health
NMCP	National Malaria Control Program
OM	Operations Manager
PMI	President's Malaria Initiative
PPE	Personal Protective Equipment
QA/QC	Quality Assurance and Control
RMS/MDH	Repartição Municipal da Saúde/Municipal Department of Health
RNJCME	National Journalist Network against Malaria and Other Major Diseases
SEA	Supplemental Environmental Assessment
SMT	Senior Management Team
SOPs	Spray Operators
TL	Team Leader
ToT	Training of Trainers
WHO	World Health Organization

EXECUTIVE SUMMARY

The President's Malaria Initiative (PMI) has been funding indoor residual spraying (IRS) in Angola since 2005 through the United States Agency for International Development (USAID), with the aim of reducing the malaria burden, especially among children less than five years old and pregnant women. In August 2011, Abt Associates (Abt) was awarded a three-year Africa-wide Indoor Residual Spraying (AIRS) project. The mandate of the project is to limit exposure to malaria and reduce the incidence and prevalence of malaria in up to 19 countries in sub-Saharan Africa.

IRS programs in Angola started in the two southern provinces of Cunene and Huila in December 2005, and gradually scaled up to three provinces, adding Huambo Province in 2008, covering five municipalities in the three provinces. In FY 2012, 141,782 structures were sprayed, protecting a total population of 676,090 residents in the provinces of Cunene, Huambo, and Huila, covering 97.7% of the structures targeted for spraying. After five consecutive years of spraying, malaria epidemiological data showed a consistent decline in the number of malaria cases in the Municipality of Huambo; therefore, IRS was stopped there after the FY 2012 spray season. Based on the epidemiological data, the Municipality of Bailundo was selected for IRS coverage for the first time for FY 2013.

With staggered start dates across five municipalities, the spray campaign was projected to be completed in 44 operational days, but was finished in 42. Spray operations began in the Municipality of Bailundo, Huambo Province on October 2 and ended on November 14. Spraying in Chibia, Huila Province started on October 9 and ended on October 17; in Lubango, Huila Province it started on October 15 and ended on November 19; and in Kwanhama and Namacunde, Cunene Province it started on October 10 and ended on October 28.

A total of 101,000 structures were targeted for spray, including 25,000 in Huambo, 60,000 in Huila, and 16,000 in Cunene. Spray operators (SOPs) found a reported 106,515 structures and sprayed 98,136 structures, resulting in a 92.1% spray coverage rate. The total population protected was 419,353; it included 74,542 children under the age of five years and 23,459 pregnant women. A summary table is included below:

Number of provinces covered by PMI-supported IRS in 2013	Three (Huambo, Huila, Cunene)
Insecticide	Pyrethroid – K-Othrine (deltamethrin)
Number of structures targeted by PMI-supported IRS in 2013	101,000
Number of structures found by SOPs in 2013	106,515
Number of structures covered by PMI-supported IRS in 2013	98,136
2013 spray coverage	92.1%
Population protected by PMI-supported IRS in 2013	419,353 74,542 children <5 years 23,459 pregnant women
Dates of PMI-supported IRS campaign	October 2 – November 19, 2013
Length of IRS spray campaign	42 operational days

Number of people trained with US government funds to deliver IRS ¹	671
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Highlights and key achievements of AIRS Angola in 2013 include:

- Established the country's first insectary. The insectary will be used for increased entomological monitoring, development of a susceptible colony for the study of insecticide resistance, and continued training to build the capacity of the government to make evidence-based decisions to improve malaria control.
- Implemented a smartphone pilot with spray operators and team leaders for spray data collection and verification as an alternative to the standard, paper-based data collection tools. Spray operators were trained to collect household spray data with smartphones to get real-time data at a reduced cost.
- Deployed multi-functional seasonal personnel across the three provinces. Historically, mobilizers had been trained to carry out advocacy/mobilization, and another group of seasonal workers trained to carry out spraying. In 2013, seasonal personnel were trained to handle both mobilization and spraying, as well as structure measurement and enumeration; this approach was used for the new spray targets in the municipality of Bailundo, Huambo. In Huila and Cunene, return seasonal workers from previous years, who had worked only in either mobilization or spraying, were trained, and carried out both functions in 2013.

¹ Based on the PMI indicator definition. It includes only spray personnel such as spray operators, 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 United States 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 GHI, the United States is helping partner countries improve health outcomes, with a particular focus on improving the health of women, newborns, and children. The President's Malaria Initiative (PMI) is a core component of 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% 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 FY 2014. Angola was selected as one of the first three African countries to benefit from PMI support in December 2005.

Angola started spraying in the two southern provinces of Cunene and Huila in December 2005, and in Namibe in 2006 – 2007, and gradually scaled up to three provinces, adding Huambo Province in 2008, covering five municipalities in the three provinces. In FY 2012, PMI-funded IRS sprayed 141,782 structures, protecting a total population of 676,090 residents in the provinces of Cunene, Huambo, and Huila, covering 97.7% of the structures targeted for spraying. After five consecutive years of spraying, malaria epidemiological data showed a consistent decline in the number of malaria cases in the Municipality of Huambo; therefore, IRS there was stopped after the FY 2012 spray season. Table 1 gives an overview of the provinces sprayed each year and the population protected.

TABLE 1: PROVINCES AND POPULATION PROTECTED SINCE 2005

Year	Provinces	Population Protected
Round 1 (2005)	Huila and Cunene	726,000
Round 2 (2006)	Huila, Namibe, and Cunene	640,000
Round 3 (2007)	Huila, Namibe, and Cunene	745,061
Round 4 (2008)	Huambo and Huila	678,030
Round 5 (2009)	Huambo and Huila	485,974
Round 6 (2010)	Huambo, Huila, and Cunene	649,842
Round 7 (2011)	Huambo, Huila, and Cunene	689,668
Round 8 (2012)	Huambo, Huila and Cunene	676,090
Round 9 (2013)	Huambo, Huila and Cunene	419,353

Once IRS was stopped in the Municipality of Huambo, and PMI remained committed to continue IRS in Huambo Province, municipalities were ranked by transmission intensity and Bailundo, Mungo and Londuimbali Municipalities were the highest in the province. The Municipality of Bailundo was selected for IRS coverage for the first time in 2013. Due to the small size and population density of Bailundo, the *overall* number of target structures was scaled down from 136,000 structures to 101,000 structures in 2013. The 101,000 structures targeted for coverage in 2013 included 25,000 in Huambo, 60,000 in Huila, and 16,000 in Cunene.

The following objectives were outlined to be achieved during the 2013 spray campaign:

- Promote cost-efficiency through due diligence, training, timely delivery, and efficiency of IRS operations.
- Carry out entomological monitoring activities to inform insecticide selection, quality and

effectiveness of IRS, and insecticide decay monitoring.

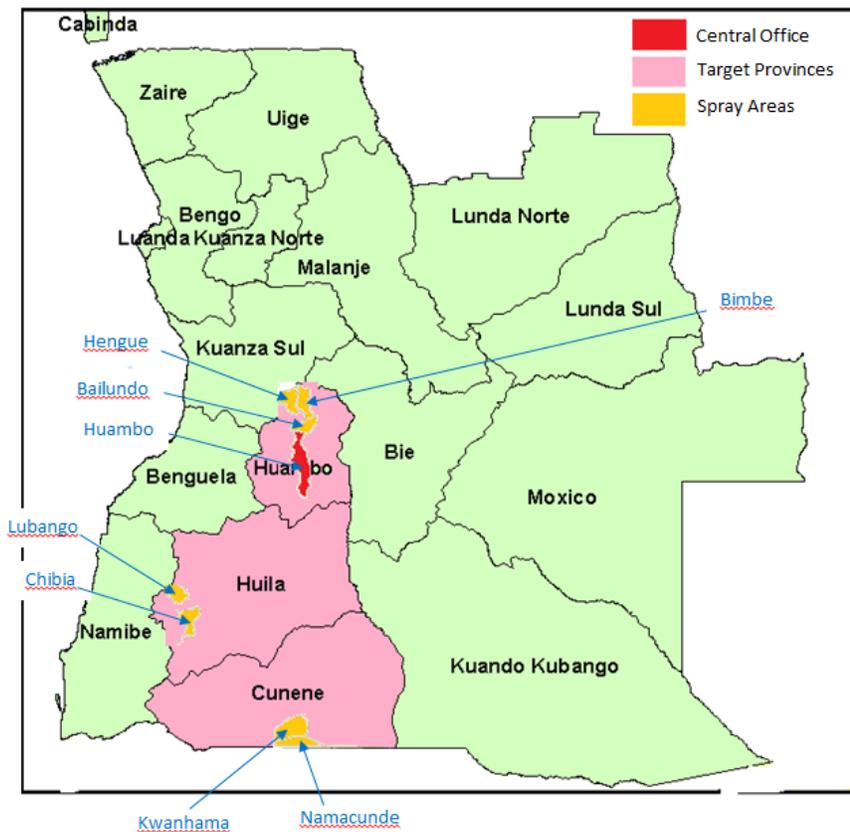
- Set up an insectary in Huambo to support entomological monitoring for all IRS target areas in the country, and provide entomological training for government staff.
- Pilot an e-mobile system approach with spray operators and team leaders for spray data collection and verification as an alternative to the standard, paper-based data collection tools. Specifically, spray operators were trained to collect household spray data with smartphones to gather real-time data, potentially at a reduced cost.
- Implement a multi-functional seasonal worker program. Training and deploying seasonal personnel to perform single functions is costly and unsustainable, as had historically been the case in Angola IRS. Specifically, the objective was to train and deploy seasonal personnel to perform more than one IRS support function, including structure measurement and enumeration, mobilization, and spraying.

2. PRE-SPRAY ACTIVITIES

2.1 SITE SELECTION

In 2013, AIRS Angola carried out IRS in the same three provinces (Huambo, Huila and Cunene) in the southern region of Angola that had benefited from IRS for the last few years. Spray site selection was based on the level of the malaria burden, population density, and accessibility, and was done in collaboration with the Ministry of Health at the national and provincial levels and PMI Angola. Huambo and Huila were selected for IRS because their malaria transmission patterns and rainfall distribution are suited to IRS as an effective intervention. Cunene was selected to align with the efforts for malaria pre-elimination in Namibia.

In Huambo province, municipality-level data showed consistently high transmission in the Bailundo, Mungo and Londuimbali Municipalities. Because of the low populations in Londuimbali and Mungo, Bailundo Municipality was the only municipality selected to benefit from IRS in Huambo Province in 2013. In Huila and in Cunene IRS continued in the same municipalities as last year, Lubango and Chibia, and Kwanhama and Namacunde respectively.



2.2 INSECTICIDE SELECTION

The AIRS Angola team, PMI Angola, the National Malaria Control Program (NMCP), and the Huambo Provincial Directorate of Health (PDH) analyzed all entomological data, and based on the evidence, agreed to continue to use a pyrethroid insecticide for the 2013 spray campaign. This decision was based largely on the susceptibility of the local vectors in WHO tube tests carried out in February 2013. K-Othrine (deltamethrin) pyrethroid insecticide, the same insecticide used for IRS in Angola since 2011, was procured for the 2013 spray campaign. Quality assurance tests carried out in South Africa, post-insecticide production and prior to shipping to Angola, showed that the insecticide met all WHO standards.

2.3 MICRO-PLANNING

Micro-planning meetings were a critical element in the successful implementation of this year's spray campaign. As part of the preparations, three planning meetings were held with key partners and stakeholders in each of the three provinces, including the Provincial and Municipal Health Directorates, civil society representatives, social media, and traditional authorities. Micro-planning meetings focused on the following critical issues:

- Spray calendar
- Operational plan
- Roles and responsibilities of partners
- Insecticide selection
- Procurement and logistics
- Spray performance target
- Monitoring and supervision plan
- Recruitment of seasonal personnel
- Training
- Advocacy and community mobilization
- Role of stakeholders before, during and after spray operations
- Sanctions of seasonal personnel involved in pilfering insecticide or other IRS commodities
- Seasonal personnel payment scale and schedule

2.4 ENVIRONMENTAL AND LOGISTICS ASSESSMENT

To conduct environmental and logistics assessments more effectively in the three provinces, operations, logistics, and environmental staff worked together and performed the assessment as a team. The existing operational sites in the three provinces were visited. The team inspected the conditions and readiness of all sites, and recommended areas for rehabilitation and improvement.

The AIRS Angola environmental compliance officer (ECO), accompanied by Provincial or Municipal Environmental officials from the MoH's Provincial and Municipal Directorates of Health, jointly carried out pre-, mid-, and post-spray environmental compliance inspections from September through December 2013 in the three provinces.

All five soak pits from the 2012 campaign and existing storage facilities appeared to be in good condition. However, there were minor cracks in some soak pits that required cement patches to close them up. The cracked concrete floors were repaired before the start of the spray campaign. A new operational site (including one soak pit, washrooms and changing room, and a storage facility) was set up in Bailundo Capital on government-owned land, in close proximity to the Municipal Directorate of Health and Municipal Hospital.

As outlined in the 2013 work plan, there is an existing approved Supplemental Environmental Assessment (SEA) covering Angola's IRS program from 2010 through 2015, with options of insecticide from three classes, including organophosphates, carbamates, and pyrethroids. The Letter Report to inform insecticide selection for the 2013 spray campaign was submitted and approved by USAID in August 2013.

The introduction of smartphones for the purposes of collecting environmental compliance data during assessments was a great innovation for the 2013 IRS campaign. With assistance from the AIRS environmental compliance manager in the home office, data for pre-spray, mid-spray and post-spray environmental compliance assessments and inspections were uploaded using an inspection checklist, which greatly facilitated data collection and supervision.

The logistics team was led by the operations manager (OM). The team's role was to assess the availability and state of all existing commodities, and quantify requirements for the 2013 campaign.

The following activities were carried out:

- Inspected storage facilities, wash bays, and soak pits, and reached consensus on strategies to be undertaken to ensure that all facilities met the minimum standards.
- Assisted districts in strategizing on how to identify potential partners and engage all stakeholders in IRS activities.
- Quantified IRS program commodities required for the 2013 spray campaign.

2.5 HUMAN RESOURCES REQUIREMENTS

The human resource requirements consisted of three parts: 1) AIRS Angola core team based in Huambo, including the Chief of Party (CoP), operations manager (OM), monitoring and evaluation manager (M&EM), environmental compliance officer (ECO), procurement & logistics coordinator, database manager, entomological coordinator, and the finance & administration team; 2) AIRS Angola provincial teams, including provincial coordinators and finance & administrative assistants; and 3) spray campaign teams (seasonal personnel), including M&E assistants (M&EA), data entry clerks (DECs), logistics assistants, field supervisors, team leaders, mobilizers, enumerators, spray operators, warehouse managers, warehouse/store assistants and spray pump technicians, washers, and security officers. Additionally, entomology technicians and larvae collectors were engaged to carry out entomological monitoring.

2.6 TRAINING

AIRS Angola conducted one Training of Trainers (ToT) session to train seasonal staff in implementation of IRS mobilization and spray campaigns. The ToT took place in Huambo one week before the trainers were expected to train the mobilization and spray teams in their respective provinces. The project conducted one ToT training that covered both IEC and spray operations modules, since AIRS Angola employed the same seasonal staff as mobilizers and spray operators for this year's campaign. The main objective of the training was to provide seasonal personnel with the skills needed to conduct quality IRS.

AIRS Angola trained 586 people as both mobilizers and spray operators for one week across the three provinces. Forty-eight spray operators, eight team leaders and three supervisors from Huambo province attended an additional week of training for the smartphone data collection and verification pilot. (See 7.8, e-Mobile Data Collection and Data Verification Pilot.) During the five-day training, AIRS Angola covered the following content:

IEC Mobilization Modules

- Introduction to malaria control
- Eligible structures for IRS in the three targeted provinces
- Advocacy of IRS
- Interaction with beneficiaries about the benefits of IRS
- Common myths and misconceptions about IRS
- Household role before, during, and after spraying

Spray Operations Modules

- Spray techniques
- Handling and managing insecticides
- Handling and maintaining spray pumps
- Personal and environmental safety
- Leading a spraying team
- Data collection and completing spray and mobilization forms
- Data verification protocol for team leaders

Additional trainings for support teams complemented mobilization and spray operations trainings. A total of 112 enumerators and their supervisors were trained in enumeration techniques and requirements to cover the new spray targets in Bailundo. Data entry clerk applicants were prescreened and brought to Huambo, trained, and sent back to their provinces.² Health clinicians from the target areas were trained to manage insecticide poisoning, and security guards, drivers, washers, warehouse assistants and technicians were trained along with the spray operators on safe insecticide handling. Table 2 describes the type of trainings conducted, and Table 3 details the number of seasonal personnel in all categories trained to deliver IRS.

² Two data centres were established in 2013; one in Huambo and the other in Huila. The M&E assistant in Cunene scanned paper forms and submitted them to the M&E cloud-based folder for retrieval and data entry in Huambo.

TABLE 2: TYPES OF TRAINING CATEGORIES

Type of Training	People Trained, by Gender			Purpose and General Topics
	M	F	TOTAL	
Supervisors for spray operators/IEC mobilizers	23	9	32	To ensure high standards of ethics and quality of data collection; a refresher training for those with previous IRS experience.
Supervisors for enumeration	5	2	7	Enumeration methodology and protocol, data collection, IRS eligible structures in the target areas and supervision.
Training of Trainers: spray operators & mobilizers	21	8	29	IRS theory and spray techniques, training, and all data collection tools.
Spray operators/IEC mobilizers	354	232	586	Data collection, IRS as a malaria intervention, community advocacy and IEC messages, environmental compliance.
M&E assistants	2	2	4	AIRS database, data collection, data clerk supervision, verification of mobilization and spray data.
Data entry clerks	10	4	14	AIRS database, data entry, data verification, cleaning.
Warehouse manager	3	0	3	Warehouse management, stock control, IRS operations, environmental compliance, etc.
Warehouse assistants/pump technicians	6	2	8	Stock handling and management, spray pump repair, and environmental compliance.
Enumerators	64	41	105	Sprayable structure eligibility, enumeration methodology, process and data collection.
Health clinicians	15	9	24	Insecticide intoxication handling and treatment.
Washers	0	24	24	Environmental compliance, standards for handling PPE washing, and safety measures for self.
Security guards	8	0	8	Warehouse and operational site security standards and requirements during spray operations.
Drivers	26	0	26	Transportation of personnel, safety and security of insecticide, PPE, road safety, and spillage handling.
Total People Trained	537	333	870	

Angolan women are breaking barriers by leading the fight against malaria through the implementation of IRS, traditionally dominated by men in most countries. The promotion of women's involvement in community health programs by the government of Angola has led to active participation of women in a series of what were perceived as traditionally male-reserved activities. Therefore, more women find it normal and fulfilling to engage actively in IRS and play a major role in the fight against malaria in their communities.

Women are increasingly taking on lead roles as trainers, supervisors, and team leaders; and they continue to have major representation as spray operators, mobilizers, warehouse support and washers. Of all the people AIRS Angola trained in IRS for both the 2012 and 2013 campaigns, ~39% were females (39.0% and 38.8%, respectively).

TABLE 3: PEOPLE TRAINED IN IRS IMPLEMENTATION

Categories	Training on IRS Delivery								Other Trainings										Total
	Training of Trainers: Spray Ops/IEC Mobilization		Spray Operations/IEC Mobilization		Data Entry & Verification		Warehouse Manager/Assistants & Pump Technicians		Enumeration		Medical Treatment of Intoxication Cases		PPE Washing		Security		Transportation		
	M	F	M	F	M	F	M	F	M	F	M	F	M	F	M	F	M	F	
ToTs	21	8																	29
Supervisors			23	9					5	2									39
Spray operators/IEC mobilizers			354	232															586
M&E assistants					2	2													4
Data entry clerks					10	4													14
Warehouse manager							3	0											3
Warehouse assistants/logistics & pump technicians							6	2											8
Enumerators									64	41									105
Health clinicians											15	9							24
Washers													0	24					24
Security guards															8	0			8
Drivers																	26	0	26
TOTAL M/F	21	8	377	241	12	6	9	2	69	43	15	9	0	24	8	0	26	0	870
TOTAL/ Training Type	29		618		18		11		112		24		24		8		26		
Grand TOTAL	870																		

3. ADVOCACY, COMMUNICATION, AND MOBILIZATION

3.1 INTRODUCTION

Advocacy, communications, and mobilization are very important for successful implementation of an IRS campaign. The IEC activities were particularly designed to facilitate the transfer of information, knowledge and skills to beneficiaries in the IRS spray areas. The following are the major advocacy and sensitization activities that were carried out during the 2013 IRS campaign:

- stakeholder meetings;
- community-level meetings;
- door-to-door mobilization;
- radio and TV discussions; and
- a mobile unit approach (i.e., truck) in Bailundo.

AIRS Angola also worked with the National & Provincial Journalist Network against Malaria and Other Major Diseases; radio stations, including Radio Mais, Radio Huambo, Radio Huila, and Radio Cunene; and TPA television station to distribute promotional materials and reach out directly to communities. The engagement of beneficiaries, stakeholders and partners ensured open discussions that reached many people of different target groups, and was aimed at increasing IRS acceptance.

3.2 PRE-SPRAY MEETINGS AND PLANNING

Pre-spray stakeholder meetings were held between May and August 2013 in all three target provinces. The main purpose of these meetings was to harness ideas and get feedback from beneficiaries and stakeholders to enhance IRS acceptance. The stakeholders included community leaders, civil society, and representatives from the Provincial and Municipal Directorates of Health. The meetings also highlighted the role of civil society and traditional authorities in community mobilization. Additionally, during the planning period, the PDHs and AIRS Angola worked together to improve IEC materials. For example, the IRS brochure was printed in four languages, including Portuguese; Umbundu (Huambo and Huila National dialects); Nhaneca (Huila National Dialect); and Kwanhama (Cunene National Language). A new IRS poster was designed and printed, and, as was the case last year, the IRS (Household) Card was designed to track household participation in IRS and to correspond to the M&E database. All communication materials were branded with the PMI and the Government of the Republic of Angola logos, as appropriate. Spray operations began on October 1, 2013 in Huambo, on October 9 in Cunene, and on October 14 in Huila. PMI, the NMCP, provincial government officials, the PDHs, municipal departments of health, partners and other local stakeholders participated to officially mark the beginning of the 2013 spray campaign. In each

province, the day was also marked with the symbolic spraying of the house of a local authority; the house of King Ekuikui III was sprayed in Bailundo Capital.

3.3 MOBILIZATION AND ENUMERATION

Implementation of the 2013 spray campaign started with a reconnaissance of the new spray target area in Bailundo. In the absence of updated maps of existing structures, teams consisting of staff from AIRS Angola and the Bailundo Municipal Department of Health (including newly recruited, trained and contracted local community health workers) conducted enumeration and surface measurements of sprayable structures in the three selected communes, Bailundo Capital, Hengue and Bimbe. Structures and compounds were enumerated using the IRS Household Card, which gave each structure a unique number tied to the Access database. A 5% structure sample was randomly selected and measured within the three communes for an average size of the structures to be sprayed. Newly contracted community health workers were recruited in collaboration with Amosmid, a national NGO that had recently reduced its work force in Bailundo due to budget cuts. A total of 21,027 structures eligible for spray were enumerated in Bailundo. This figure was about 4,000 structures fewer than the initial target, which was based on the population census provided by Bailundo Repartição Municipal da Saúde (RMS). Structure enumeration and measurement was conducted only in Bailundo in 2013, since it was Bailundo's first time for IRS coverage.

During mobilization in the three provinces, mobilizers reported finding far more eligible structures than the campaign target (132,435 vs. 101, 000 structures) (Table 4). The majority of the difference between the target and the mobilization results was detected in Huila, where the AIRS M&E team and AIRS Senior Management discovered, during data verification field visits, that mobilizers had recorded non-existing structures. Mobilizers in Huila recorded a total of 102,128 eligible structures, a 57.5% increase over the number of structures found by SOPs in 2012 (64,857). A lack of strong field supervision during mobilization, as observed by the AIRS M&E team, may have led mobilizers to falsely and/or erroneously record structures found and sensitized in Huila. Since spray operators were the ones who had also mobilized, the issue was immediately addressed with them, their team leaders and supervisors, to ensure that only eligible structures found during spray operations were recorded. Additionally, the number of structures found by spray operators during spray reflects data from the 2012 campaign with a slight increase (~15%) that can be attributed to the continued growth and expansion of Lubango.

In Cunene, mobilizers found a total of 15,364 structures, on target with the number of structures found by SOPs in 2012; and in Bailundo, mobilizers found nearly 6,000 structures fewer than enumerators, largely due to the farming season (residents were out farming and were not home to receive mobilizers). Thus, we believe the spray data more accurately reflect the number of eligible structures in the three provinces based on the number of structures found by spray operators in the 2012 campaign. See Section 7.6, 2013. Campaign Results, for the total eligible structures found in Huila.

Mobilization consisted of sensitizing communities to IRS and the importance of this intervention in malaria prevention, and disseminating the IRS (Household) Card with the unique, serial IRS structure number. Through mobilization, AIRS Angola reached 221,688 people over the age of 15 with IRS messages. The target population was informed about program objectives, spray campaign procedures, and the precautions necessary to be safe. They were given an IRS brochure in their local dialect language or in Portuguese. Beneficiaries were also asked if they would accept IRS; 99.7% of the reached population responded that they would accept having their home sprayed.

TABLE 4: SUMMARY OF AIRS ANGOLA 2013 MOBILIZATION CAMPAIGN

Province	Structures Found	Structures Sensitized		Adults Reached with IRS Message			IRS Acceptance		IEC Materials Distributed
		Yes	No	Total	Males	Females	Yes	No	
Cunene	15,364	14,749	615	29,639	13,326	16,313	14,644	105	6,769
Huambo	14,943	14,463	480	21,583	8,783	12,800	14,312	151	13,432
Huila	102,128	101,872	256	170,466	75,845	94,621	101,670	202	18,537
Total	132,435	131,084	1,351	221,688	97,954	123,734	130,626	458	38,738

Mobilizers distributed printed IEC materials to households during mobilization. Once the spray campaign began, all seasonal personnel were deployed to spraying, with the exception of one to two mobilization brigades. This seasonal staff remained in the field as mobilizers, going ahead of spray teams to remind households to prepare their homes for spray that day, if they had not already. These mobilizers also provided support to households that needed help preparing their homes, primarily the elderly and pregnant women. Spray operators carried IEC materials in case they approached a household that had not originally been reached during mobilization.

In addition to door-to-door communication efforts, AIRS Angola displayed IRS posters and banners in the provincial and municipal public buildings before the start of the IRS activity to promote IRS acceptance. Table 5 presents the types and numbers of communication materials produced and distributed during the mobilization and spray campaigns.

TABLE 5: IRS COMMUNICATION MATERIALS

Item	No. Distributed
Posters	400
Banners	6
IRS Brochure	35,000
T-Shirts	1300
Cap	1,000
PMI Stickers	360

AIRS Angola held advocacy meetings and participated in government and other partners' health events to promote IRS awareness, and used radio, television and other media outlets to inform communities about IRS and the spray campaign. For example, we aired 55 radio spots with IRS messages before and during the spray campaign in three local dialects, as well as in Portuguese. Table 6 lists all IRS advocacy activities conducted by media outlet.

TABLE 6: IRS ADVOCACY ACTIVITIES

Activity	Total
Advocacy meetings & events: with PMI, NMCP, National & Provincial Malaria Forum, World Malaria Day, National Journalist Network against Malaria and Other Major Diseases (RNJCMGE), Radio Cunene, Radio Huambo, Radio Mais, Radio Huila, the PDHs, municipal departments of public health, and PMI Partners Meetings	75
Radio spots (mobilization, before and during spray campaign)	55
Radio program (interactive show)	25
Television	15
Newspaper articles	4
Mobile unit	1
Spray campaign launch	3
Evaluation meeting	3

4. SPRAY ACTIVITIES

4.1 INTRODUCTION

With staggered start dates across the five municipalities, the 2013 spray campaign was projected to be completed in 44 operational days, but finished in 42. The number of operational days per site is summarized in the table below. A total of 101,000 structures were targeted for coverage, including: 25,000 in Huambo, 60,000 in Huila, and 16,000 in Cunene. AIRS Angola found a reported 106,515 structures, of which 98,136 structures were sprayed, resulting in a 92.1% spray coverage. The total population protected was 419,353; this includes 74,542 children under the age of five years and 23,459 pregnant women.

TABLE 7: LENGTH OF THE SPRAY CAMPAIGN, BY OPERATIONAL DAYS

Province	Municipality	Spray Campaigning Period	Number Days of Operational Days
Huambo	Bailundo	October 2 – November 14, 2013	37
Huila	Chibia	October 9 – 17, 2013	8
	Lubango	October 15 – November 19, 2013	30
Cunene	Kwanhama	October 10 - 28, 2013	15
	Namacunde	October 10 – 28, 2013	12
Total Number of Operational Days			42 Days

4.2 FIELD SUPERVISION

Field supervision was provided by the AIRS Angola Senior Management team, PDH, Municipal Department of Health (MDH)/Repartição Municipal da Saúde (RMS), and community traditional authorities at the provincial and municipal levels. The spray campaign was rigorously supervised at every level to ensure smooth service delivery, ethical behavior, and good performance towards achieving results. The spray team structure was set up as follows:

- Spray operators were grouped into teams of six. Each team was supervised by a team leader. A supervisor was responsible for supervising three teams. Supervisors reported directly to the senior field leaders, who in turn reported to the provincial coordinator.
 - Three teams of six SOPs (18 SOPs total); three team leaders constitute a brigade, which is supervised by the Supervisor. Supervisors have oversight over one brigade, and are supervised by the senior field supervisors (Oficial de Campo). Senior field supervisors supervise up to four brigades.
- The AIRS Angola Senior Management Team (SMT), CoP, OM, ECO, and M&EM traveled to the three provinces throughout the spray campaign to coordinate routine daily supervision by working closely with the provincial coordinator and other field supervisors and government stakeholders.
- Regular meetings were held at all levels, in person, or by phone, at the national, provincial and municipal levels to review progress, make necessary adjustments, and boost field teams' morale.

4.3 DATA REPORTING

Spray data was collected and entered into the database on a daily basis. In Bailundo, smartphone spray data was launched in real time. Spray operators collected the data, and team leaders checked and verified spray operator forms for accuracy. Team leaders oversaw spray operators using smartphones for the data collection. Additional data verification was done by field supervisors, provincial coordinators and M&E assistants prior to data forms being transferred to the data center for data entry. Weekly Spray Campaign Progress Reports were distributed to PMI Angola and COR teams, the MoH national, provincial and municipal levels, and Abt's Home Office.

4.4 LOGISTICS AND STOCK MANAGEMENT

The central-level warehouse facility in Caala (in Huambo Province) continued to serve as the distribution center for insecticide, personal protective equipment (PPE), and other IRS materials and supplies. Provincial and municipal warehouse facilities were managed by a warehouse manager and by warehouse assistants/logistics and pump technicians, who also ensured distribution and close supervision of supplies at the operational site storage facilities, and handled spray pump repair and maintenance. There are five warehouse facilities and operational sites in the three provinces.

The three main warehouses, located in Caala, Huambo; Lubango, Huila; and in Ondjiva, Cunene, are privately owned, and are leased and paid for by AIRS Angola. The Cunene office/warehouse combination building was leased under a short-term agreement for the duration of the spray season, as it had remained vacant since the close-out by AIRS Angola in May 2013. Given the distance from the central warehouse to Bailundo, storage facilities were created locally to support the spray operations. In Hengue, a section of the old Posto de Saúde/Health Facility building was fitted and used for IRS storage at no cost for storage to AIRS

Angola. (A new, larger Health Facility had opened in October 2012.) In Bailundo Capital, a storage facility and operational site was set up to support both Bailundo Capital and Bimbe spray sites. The storage facility was set up with two 40-ft. shipping containers, positioned side by side, covered with a common zinc roof, with an open area in between the two containers for additional work space. Containers were fitted with windows, and burglar bars. This facility was established on government-owned property, in an open area on the grounds of the Bailundo Municipal Hospital; there are no leasing fees for it, and the only cost to AIRS Angola was the initial set-up.

Planning and preparation for the 2013 spray campaign began with a logistics assessment and the development of the procurement plan, followed by the procurement of goods. It was critical to ensure that all program commodities, including insecticide, PPE, and other supplies, were delivered to the central warehouse on time for the campaign. Daily logistics management was conducted by the warehouse manager, warehouse assistants, and the provincial logistics assistant.

Records were monitored and updated using stock cards for each item, with details on transactions, quantities, dates and destination. Regular physical stock counts were conducted to ensure that the actual stock corresponded with records on stock cards. A weekly inventory audit was conducted by the logistics coordinator or warehouse manager at each operational site. This standard procedure is used to support requests and approvals for additional materials, and to reconcile central warehouse stock in Caala, Huambo.

Daily stock movement was tracked using the Stock Control forms. In addition, signed copies of requests, approvals 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 and other IRS commodities were carefully tracked and managed from the central warehouse to the provincial and municipal storage facilities and operational sites. Empty insecticide sachets were tracked daily at the operational sites by the warehouse facility manager. They were accounted for by recording the number of insecticide sachets each team leader received daily, and how many were used.

The warehouse manager used the Insecticide Tracking Sheets to record the number of insecticide sachets received by each team leader each morning. At the end of each day, the warehouse manager recorded the number of returned sachets, including empty and full sachets, on the tracking sheet. Full sachets were returned to the main stock, while empty sachets were counted and placed in a designated area within the warehouse. Data was transferred onto the stock cards, and the corresponding adjustments were made to match the physical stock. Random and unannounced visits were conducted to the warehouses by the CoP, OM and the ECO throughout the spray campaign.

4.5 SPRAY CAMPAIGN TRANSPORTATION

Transportation of the multi-functioning seasonal personnel was handled with 3- to 6-ton trucks retrofitted with side railings, seating benches in the middle or on the side, and tarp coverage. For hard- to-reach areas with poor road conditions, Land Cruisers or Land Rovers were required and used for transportation purposes. A total of 41 vehicles were contracted to support the spray campaign in the three provinces, as outlined below.

TABLE 8: DISTRIBUTION OF VEHICLES, BY PROVINCE

Province	Vehicles for Enumeration Mobilization/Operations	Vehicles for Supervision	Total
Huambo	10	3	13
Huila	15	2	17
Cunene	8	3	11
Total	33	8	41

4.6 SAFETY AND ENVIRONMENTAL COMPLIANCE

Prior to the beginning of the spray campaign, all spray personnel, including spray operators, team leaders, supervisors, warehouse staff, washers, and drivers, underwent medical tests to ensure physical fitness to participate in the spray campaign. Medical testing included a routine examination and pregnancy test of all females. Anyone found unfit or pregnant was removed from further participation in spraying, washing or any other tasks which expose people to insecticides. At the midpoint of the campaign in Bailundo, which lasted over 30 operational days, pregnancy tests were repeated, at which point 12 females tested positive, including a brigade supervisor, 2 team leaders and 9 spray operators. All 12 women were integrated into the mobilization brigade, which continued to mobilize communities and provide assistance to households to prepare their houses for spraying, particularly for the elderly, pregnant women or people with disabilities. In Huila, where the campaign lasted only 30 operational days, pregnancy tests were carried out on the last day of spraying, and four females tested positive. In Cunene, mid-spray campaign pregnancy tests were not conducted, as the spray campaign lasted for only 15 operational days. Environmental and human safety regulations were strictly adhered to throughout the spray campaign; the strict use of PPE, and handling of spray pumps and insecticides, were closely monitored at all times.

Transportation of insecticides from the central warehouse to the provincial warehouses was handled by enclosed trucks, equipped with spill kits, first aid kits, the Material Safety Data Sheet (MSDS) and accident/emergency procedures. The logistics coordinator or the environmental compliance officer accompanied each of the trucks to ensure safety and security of the insecticide transfer. Spray operators were transported from the operational sites to the field using three- to six-ton trucks (see above) that had been inspected for mechanical condition and road-worthiness, to ensure compliance with safety and environmental requirements as outlined in the Best Practices Manual (BMP).

Wash areas and soak pits were monitored throughout the campaign. Soak pit and wash areas were fenced and gated to ensure that non-authorized entities could not access the premises. Progressive (triple) rinsing was used at each soak pit to wash spray pumps. Trained washers washed the PPE over the soak pits. The spray teams either showered or washed their faces, feet and hands in the washrooms at the end of every work day, and were given a small glass of milk to drink prior to heading home for the day.

Mid-spray environmental compliance inspections were carried out at each of the operational sites and warehouses to ensure mitigation standards were adhered to. The inspection was carried out by the AIRS Angola ECO in collaboration with the provincial or municipal environmental officials. The inspection teams inspected the appropriate use of PPE by all spray

personnel, washers and warehouse teams. Warehouse stock and ledgers, transportation of spray personnel, location of warning signs and first aid kits, and fire extinguishers were also inspected. In addition, the storage and tracking of solid waste was inspected. Lastly, the team monitored household preparations prior to spraying, and ensured that proper instructions were given to the residents.

4.7 ADVERSE REACTIONS AND ACCIDENTS

There were no vehicle accidents, no insecticide spillages, and no adverse reactions suffered by seasonal personnel during the 2013 spray campaign.

5. POST-SPRAY ACTIVITIES

5.1 EVALUATION MEETINGS

Evaluation Meetings were held in the three provinces. The main goals and objectives of these meetings were to report results, document challenges and opportunities encountered during the spray campaign, discuss lessons learned, and make recommendations for future campaigns. The main topics addressed included:

- Review the spray campaign process, experiences and achievements, and next steps.
- Share and review preliminary data from the campaign. Share results and recommendations of entomological monitoring and studies conducted.
- Review challenges and make recommendations for future campaigns.
- Discuss capacity-building and sustainability of IRS in Angola.
- Reach a consensus on the recommendations and way forward for next year.

Meetings were attended by the following:

- PMI Angola representatives
- Provincial and Municipal Directorate of Health; provincial director, malaria supervisor, malaria program officer, city administrator, and others
- Municipal authorities including army and police departments
- Health facilities
- Churches
- Political parties (Bailundo)
- AIRS Angola

5.2 POST-SPRAY ENVIRONMENTAL ASSESSMENT

The post-spray environmental compliance assessment was conducted on November 18 and 26 and December 2, 2013, in Huila, Huambo, and Cunene provinces respectively. All IRS equipment and supplies were collected from the operational sites, and campaign waste was collected, counted and transported to the central warehouse in Caala. Soak pits and wash bays were washed and covered and the gates were securely locked; warning signs remain posted, and surrounding areas were maintained clean of weeds and other garbage.

5.3 WASTE MANAGEMENT

Solid waste generated by the spray campaign was placed in the insecticide storage facility in all warehouses, segregated from PPE and other supplies and equipment. It was separated, repackaged in each of the provincial warehouses, and further consolidated at the central warehouse. Nearly 1,000 kilos of IRS solid waste generated by the 2013 spray campaign was incinerated on February 5, 2014 at Recolix Engenharia Ambiental in Luanda, the only facility licensed and accredited by the Ministry of Environment in Angola that meets best management practices for solid waste management for IRS. The Certificate of Incineration can be found below in Figure 1.

TABLE 9: SOLID WASTE INVENTORY

Item	Province			Total in #s
	Huambo	Huila	Cunene	
Masks	3,015	7,854	2,484	13,353
Empty sachets	6,056	30,813	5,739	42,608
Overalls			23	23
Backpacks	33	229	56	318
Boots	7	8		15
Empty cartons		197		197
Plastics/tarps		12		12
Visors	59	286	51	396
Brackets	34	29		63
Helmet liners	46	39		85
Clipboards			23	23
Towels		47		47

Figure I: Certificate of Incineration, 2013 Spray Campaign Solid Waste

																
Certificado de Destruição de Resíduos N.º: 100																
<p>Declaramos, para os devidos fins, ter destruído o(s) resíduo(s) abaixo descrito(s), pelo processo de Incineração Pirofítica, conforme padrões exigidos pelo Novo Modelo de Gestão de Recolha e Tratamento de Resíduos, seguindo restritivas normas de segurança e respeito ao Meio Ambiente.</p>																
EMPRESA: ABT - ASSOCIATES																
Endereço: Rua N.º102, Bairro Kapango Urbano - HUAMBO (ANGOLA)																
Resíduo (s) Incinerado (s):																
<table border="1"><thead><tr><th>Denominação</th><th>Quantidade</th><th>Unidade</th></tr></thead><tbody><tr><td>Incineração de Máscaras, Luvas, Caixas de Papel vazias, Saquetas de Insecticidas e Interiores de Capacetes</td><td>841</td><td>kg</td></tr><tr><td></td><td></td><td></td></tr><tr><td></td><td></td><td></td></tr><tr><td>Total:</td><td>841</td><td>Kg</td></tr></tbody></table>		Denominação	Quantidade	Unidade	Incineração de Máscaras, Luvas, Caixas de Papel vazias, Saquetas de Insecticidas e Interiores de Capacetes	841	kg							Total:	841	Kg
Denominação	Quantidade	Unidade														
Incineração de Máscaras, Luvas, Caixas de Papel vazias, Saquetas de Insecticidas e Interiores de Capacetes	841	kg														
Total:	841	Kg														
Ref. Factura n.º 69/2014																
Data: 25/02/2014	 Paula Cristina G. Neto "Directora Executiva"															

5.4 INVENTORY

Following completion of the spray campaign, all the commodities at the municipal level were transported to the central warehouse. Warehouse managers updated their stock records and handed them over to the provincial coordinators. At the provincial level, stock records were updated to show the remaining stock and audited by the logistics coordinator and operations manager. See Table 10 below for the remaining inventory of IRS commodities and supplies.

TABLE 10: POST-SPRAY CAMPAIGN PROGRAM INVENTORY

S/N	Description	Pre-Spray Campaign Inventory	Used or Damaged Inventory	Lost or Stolen Inventory	Post-Spray Campaign Inventory
1	Overalls	1,048	23	0	1,025
2	Boots	603	15	0	588
3	Helmets	1,056	484	0	572
4	Visors	993	396	0	597
5	Visors brackets	745	63	0	682
6	Reflecting vests	130	0	0	130
7	Gloves	2,525	445	0	2,080
8	Masks	27,010	13,401	10	13,619
9	Spraying pumps 8L	671	90 ³	0	581
10	Spraying pumps 10L	114	0	1	113
11	Water containers (500L)	1	1	0	-
12	Water containers (2000L)	2	0	0	2
13	Water containers (2500L)	2	0	0	2
14	Water containers (5000L)	5	0	0	5
15	Generator	4	1	0	4
16	Basins	44	0	0	44
17	Metallic drums (200L)	4	0	0	4
18	Plastic drums (200L)	43	0	0	43
19	Plastic drums (100L)	29	3	0	20
20	Jars (2L)	30	0	0	30
21	Buckets (10L)	130	0	1	129
22	Fire extinguisher	6	0	0	6
23	Pallets	99	0	0	99
24	Megaphones	42	0	0	42
25	Backpacks	578	318	0	260

³ Damaged pumps are inventory transferred from the previous contractor.

S/N	Description	Pre-Spray Campaign Inventory	Used or Damaged Inventory	Lost or Stolen Inventory	Post-Spray Campaign Inventory
26	Plastic chairs	63	1	0	62
27	First Aid kits containers	20	0	0	20
28	Brooms	10	0	0	10
29	Provets	10	0	0	10
30	Ladders	1	0	0	1
31	Strainers	1,900	280	0	1,620
32	Pump repair kits	30	-	0	29
33	Thermometers	4	0	0	4
34	Nozzle assembly (complete)	423	0	0	423
35	Nozzle flow regulator	525	0	0	525
36	Nozzle gasket	900	0	0	900
37	Scale	1	0	0	1
38	40" foot container	1 ⁴	0	0	0
39	Pump hangers	6	1	0	5
40	Wooden benches	12	0	0	12
41	Insecticide	67,198	42,842	1	24,355

⁴ 40" foot container was utilized as part of the development of the Bailundo operational site, as a storage unit.

6. ENTOMOLOGY

6.1 INSECTARY

A critical component of IRS is entomological monitoring to ensure that the insecticide sprayed is effective against local mosquito populations, and to measure the lasting efficacy of the insecticide. This monitoring has been challenging due to the lack of an insectary and to limited human resources for training, limited experience in entomology, and continued difficulty finding sufficient numbers of *An. gambiae* s.l. for testing. For the last couple of years, AIRS Angola established a temporary mosquito rearing room in the project office in Huambo to support entomological activities, including rearing larvae collected in the field into adulthood for insecticide susceptibility testing, and conducting quality assurance of the IRS, assessing insecticide decay rates, and identifying the vectors to determine species. The rooms were very small and not ideal for rearing and keeping mosquitoes. Angola's first-ever insectary was launched on September 26, 2013, highly celebrated with the presence of key government and donor officials including the Minister of Health, Dr. Serra Van-Dunem; the Vice Governor for Social Sector, Dr. Guilherme Tuluka; the USAID Mission Director, Dr. Teresa McGhie; the National Coordinator of the National Malaria Control Program, Dr. Filomeno Fortes; the Provincial Director of the Provincial Directorate of Health of Huambo, Dr. Carlos Frederico Juliana; and the PMI Senior Malaria Advisor, Dr. Susann Nasr, among many others. The insectary is located on the grounds of the Huambo Sanatorium Hospital, which speaks to partnership with the Provincial Directorate of Health of Huambo, who played a key role in making government property available for the insectary.

A 40-foot shipping container was transformed into a working insectary. The fully equipped and functioning laboratory supports entomological monitoring for IRS, including rearing of a mosquito colony for insecticide susceptibility testing, quality assurance of the IRS campaign, tracking insecticide decay rates, and identification of vector to species level. The insectary also will serve as a training facility for other health activities for Huambo and other provinces.

The insectary currently lacks a susceptible mosquito colony; AIRS Angola continues discussion with government authorities to get permission to be able to bring eggs of a susceptible mosquito colony into the country.

6.2 INSECTICIDE RESISTANCE

An insecticide resistance study was conducted in February 2013 by the AIRS Angola entomological team to help guide appropriate insecticide selection for the 2013 spray season. One- to five-day-old adult mosquitoes from field collected larvae and pupae were tested. The emergent *Anopheles* mosquitoes were first sorted into species. In Lubango, Huila, *An. coustani* and *An. gambiae* s.l. were the two most prevalent *Anopheles* species noted. In Huambo Municipality a more diverse group of *Anopheles* species was detected emerging from the field-collected larvae and pupae, including *An. coustani*, *An. gambiae* s.l., *An. d'thali*, *An. theileri* and *An. pretoriensis*. Only nine female *An. gambiae* s.l. were noted throughout the collection period in Huambo.

The *Anopheles* species tested for their susceptibility were dependent on the distribution and availability of mosquitoes in each of the two provinces visited. In Huila, *An. gambiae* s.l. was obtained in sufficient numbers and was tested to determine their susceptibility to three different insecticides: deltamethrin 0.05%, bendiocarb 0.1%, and fenitrothion 1%. In total, 300 mosquitoes were tested for the three insecticides; 100 mosquitoes per insecticide. In Huambo, however, the tests were conducted for two groups of *Anopheles* mosquitoes: *An. coustani* and other *Anopheles*. The other *Anopheles* (*An. gambiae* s.l. plus) included a mix of *An. gambiae* s.l., *An. d'thali*, *An. theileri* and *An. pretoriensis* that were identified to species after the test. A mix of both male and female mosquitoes was used at each site.

Among the 110 *An. gambiae* s.l. plus mosquitoes tested for deltamethrin in Huambo, 53 (44.17%) were females and 67 (55.83%) were males. Of the 53 female *Anopheles* identified to species after the test, 4, 6, 8 and 35 were found to be *An. gambiae* s.l., *An. d'thali*, *An. theileri* and *An. pretoriensis*, respectively. The males were not identified to species. Similarly, among the 75 *An. gambiae* s.l. plus mosquitoes tested for bendiocarb, 37 (49.3%) were females and 38 (50.7%) were males. The species composition of the 37 females tested for bendiocarb was 5 *An. gambiae* s.l. and 32 *An. pretoriensis*. In Huila, 46% of the *An. gambiae* s.l. tested were female and 54% were male (Table 11).

TABLE 11: MALE AND FEMALE PROPORTIONS OF THE ANOPHELES MOSQUITOES TESTED IN HUAMBO AND HUILA PROVINCES

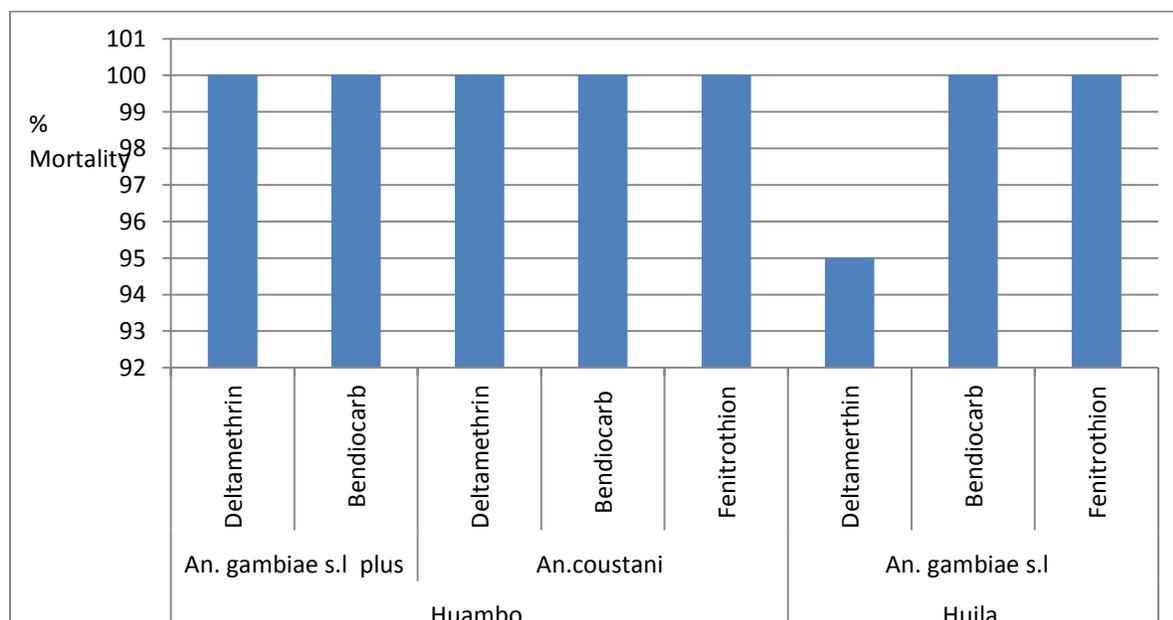
Province	Insecticides Tested	Species	# Mosquitoes Tested	Female	Male	% of Female Mosquitoes
Huambo	Deltamethrin	<i>An. coustani</i>	110	51	59	46%
	Fenitrothion	<i>An. coustani</i>	50	29	21	58
	Bendiocarb	<i>An. coustani</i>	89	40	49	45%
	Total <i>An. coustani</i>		249	120	129	48%
	Deltamethrin	<i>An. gambiae</i> s.l. plus	120	53	67	44%
	Bendiocarb	<i>An. gambiae</i> s.l. plus	75	37	38	49%
	Total <i>An. gambiae</i> s.l. plus		195	90	105	46%
Huila	Deltamethrin	<i>An. gambiae</i> s.l.	100	46	54	46%
	Bendiocarb	<i>An. gambiae</i> s.l.	100	45	55	45%
	Fenitrothion	<i>An. gambiae</i> s.l.	100	42	58	42%
	Total <i>An. gambiae</i> s.l.		300	133	167	44%

During testing, mosquitoes were exposed to WHO insecticide-treated papers in test tubes for one hour. The knock-down (KD) was observed at 15, 30, 45 and 60 minutes post exposure. The mosquitoes were kept in holding containers on 10% sucrose solution for 24 hours prior to measuring mortality. The dead female mosquitoes were identified into species and preserved separately in RNA later and on silica gel. The observed mortalities were corrected using Abbott's formula when the control mortality was between 5% and 20%.

TABLE 12: INSECTICIDE SUSCEPTIBILITY TESTING RESULTS, HUAMBO AND HUILA PROVINCES

Province	<i>Anopheles</i> species tested	Insecticides tested	No. of replicates	No. of mosq. tested	% observed test mortality rate	% corrected mortality
Huambo	<i>An. gambiae</i> s.l. plus	Deltamethrin	6	120	100	N/A
	<i>An. gambiae</i> s.l. plus	Bendiocarb	3	75	100	N/A
	<i>An. coustani</i>	Deltamethrin	5	110	100	N/A
	<i>An. coustani</i>	Bendiocarb	4	89	100	N/A
	<i>An. coustani</i>	Fenitrothion	5	50	100	N/A
Huila	<i>An. gambiae</i> s.l.	Deltamethrin	5	100	95	94.7
	<i>An. gambiae</i> s.l.	Bendiocarb	5	100	100	N/A
	<i>An. gambiae</i> s.l.	Fenitrothion	5	100	100	N/A

Figure 2: Insecticide Susceptibility Test Results, Huambo and Huila Provinces



Additional susceptibility testing was conducted in April 2013 with mosquitoes specifically from Bailundo municipality; a result of 100% mortality was observed after exposing 60 *An. gambiae* s.l. to deltamethrin.

6.3 MONITORING VECTOR DENSITY, DISTRIBUTION, SEASONALITY AND BEHAVIOR

6.3.1 CDC LIGHT TRAP COLLECTION

A CDC (Centers for Disease Control) light trap is installed in the bedroom beside a bed with a mosquito net. The human bait will sleep under the net, while the light trap will attract female *Anopheles* that have entered the room to bite the person under the net, and thus can be used as a proxy to study the biting rate. In the house, only one person (known as a sleeper) sleeps alone during the night. One CDC light trap is positioned indoors, fitted with incandescent bulbs and laid close to the human volunteer sleeping under an untreated bed net in his/her usual sleeping place. The light trap is installed at about 1.5 m above the floor next to the foot of the bed of the person. Trapped mosquitoes are removed the next morning.

6.3.2 PYRETHRUM SPRAY CATCH (PSC)

Spray sheet collection involves using a pyrethrum space spray to knock down mosquitoes resting inside a house, and collecting them on white sheets spread on the floor and other flat surfaces in the house.

PSC Protocol

- Ensure that the insecticide used for space spray kills target mosquitoes.
- Remove all food and cover water jars.
- Spread the white sheets on the floor, covering wall-to-wall.
- Close the windows, if any.
- Spray the aerosol from the ceiling until the house/room is full of insecticide mist.
- Close the door.
- Wait for 5 –10 minutes (depending on the type of the aerosol used) until the target mosquitoes are knocked down on the white sheet.
- Starting from the doorway, pick up the sheets one at a time by their corners. Carry the sheets outside. Collect the knocked-down mosquitoes outside in daylight using forceps. Place collected mosquitoes in a labelled Petri dish with a layer of damp cloth or wool and paper on top of the cloth. Use separate Petri dishes for each house, and label the dishes with all the essential information.

The first data collection was carried out at the end of April through the beginning of May 2013 while setting up the sentinel sites, and subsequently in late September through early October 2013 before the onset of spraying. Subsequent entomological data collections were carried out during the spray season and through the rainy season. Collections were carried out in the seven sentinel sites, as listed in Table 13 below, of which five are located in intervention areas and two are located in non-intervention, or control, areas.

TABLE 13: LIST OF SENTINEL SITES

Bailundo Municipality, Huambo Province	Location/Village	Sentinel Site Status
Bailundo Capital	Samora	Intervention areas
	Velha Chica	
	Bunju	
	Candandi	
	Bairro Hospital	
	Mana Kulele	Control areas
	Monte Belo	

CDC light traps were set indoors in selected houses of each village. A total of 10 traps were hung at 6:00PM in sleeping areas, one night per site per month, 1.5 meters high from the floor and about 50 centimeters from a human sleeping under a bed net. The mosquitoes were collected from the traps the next morning at 6:00AM and were put into cups, which were kept in a cooler for transportation to the insectary. The insecticide-treated net (ITN) coverage was low in both intervention and control areas. AIRS Angola used non-treated bed nets to protect the people used as human baits for the CDC light trap collections in all seven sentinel sites, comprising 10 different houses per site, for a total of 70 houses sampled monthly.

Pyrethrum Spray Catches (PSC) were used to sample in seven neighborhoods; 10 different houses were sampled from each site monthly. Collection was carried out in the morning hours between 6:00 AM and 7:30 AM. White sheets were extended after removing food and utensils and covering water containers. A pyrethroid-based aerosol, Supertox, was sprayed from the ceiling until the room was filled with a fine mist.

The technicians then closed the door and left the room quickly. Ten minutes later, the doors were opened and knocked-down mosquitoes were collected, starting at the door. Results showed that the PSC method was less efficient than the CDC light traps. A third, new mosquito sampling method, the Prokopack aspirator, was also tried in late 2013, and based on the initial trial, the Prokopack appeared to be the most efficient collection method introduced in Angola to date. However, the team had only one machine, and its battery didn't have a proper charger. AIRS Angola will include the Prokopack aspirator as an alternative sampling approach in its 2014/15 work plan and budget, but for the remainder of the current work plan year, the team has continued using the PSCs and CDC light traps.

The indoor collection results showed that the *An. gambiae* s.l. density decreased after spraying. *An. gambiae* s.l. density increased from the end of October onwards due to the rains. The highest numbers of mosquitoes collected were *Culex quinquefasciatus*, followed by *An. gambiae* s.l., *An. coustani* and *Aedes aegypti*.

TABLE 13: SUMMARY OF MOSQUITOES PER SPECIES, COLLECTED BY CDC LIGHT TRAPS, MAY, OCTOBER – DECEMBER 2013

Period	Species	Control Area	Intervention Area	Total No. of Mosquitos Collected
		No. of Mosquitos Collected per Species per Month	No. of Mosquitos Collected per Species per Month	
May	<i>Aedes</i>	8	13	21
	Culicines	147	104	251
	<i>An. coustani</i>	2	0	2
	<i>An. gambiae</i> s.l.	27	108	135
	Vector density (<i>An. gambiae</i> s.l. per house per day)	1.35	2.16	1.93
October	<i>Aedes</i>	0	0	0
	Culicines	17	2	19
	<i>An. coustani</i>	0	0	0
	<i>An. gambiae</i> s.l.	1	6	7
	Vector density (<i>An. gambiae</i> s.l. per house per day)	0.05	0.12	0.1
November	<i>Aedes</i>	1	0	1
	Culicines	2	142	144
	<i>An. coustani</i>	1	0	1
	<i>An. gambiae</i> s.l.	18	8	26
	Vector density (<i>An. gambiae</i> s.l. per house per day)	0.9	0.16	0.37
December	<i>Aedes</i>			
	Culicines	36	786	822
	<i>An. coustani</i>	1	6	7
	<i>An. gambiae</i> s.l.	14	27	41
	Vector density (<i>An. gambiae</i> s.l. per house per day)	0.7	0.54	0.585

The total number of *An. gambiae* s.l. collected during the baseline using CDC light traps was 6 in the intervention areas in October. The average density of *An. gambiae* s.l. per house/day was 0.12 right before the spray campaign. In the subsequent two months, eight and 27 *An. gambiae* s.l. were collected one and two months after the spray, with an average mosquito density of 0.16 and 0.54 per house per day, respectively. Vector density was 33% and 3.5 times higher in November and December compared to at the baseline.

From the control villages, one *An. gambiae* s.l. was collected at the baseline, with a vector density of 0.05 mosquitoes per house per day in October. The vector increased by 17 and 13 specimens respectively one and two months after spraying compared to at the baseline. On average, the increase in vector population appears to be higher in the control villages compared to in the intervention villages. Though the sample size is too small to make a sound conclusion, there is an indication that IRS had an impact in suppressing vector density, at least in the study areas.

The PSC data is too scarce to make any conclusions, as only 3 *An. gambiae* s.l. were collected.

TABLE 15: SUMMARY OF MOSQUITOES PER SPECIES COLLECTED BY PSC, MAY, OCT – DEC 2013

Period	Species	Control	Intervention	Mosquitoes Collected
		No. collected	No. collected	
May	<i>Aedes</i>	0	0	0
	Culicines	98	134	232
	<i>An. coustani</i>	1	1	2
	<i>An. gambiae</i> s.l.	0	1	1
October	<i>Aedes</i>	0	0	0
	Culicines	0	11	11
	<i>An. coustani</i>	0	0	0
	<i>An. gambiae</i> s.l.	1	1	2
November	<i>Aedes</i>	0	0	0
	Culicines	3	0	3
	<i>An. coustani</i>	0	0	0
	<i>An. gambiae</i> s.l.	0	0	0
December	<i>Aedes</i>	0	0	0
	Culicines	39	122	161
	<i>An. coustani</i>	0	0	0
	<i>An. gambiae</i> s.l.	0	0	0

6.4 QUALITY ASSURANCE & DECAY MONITORING

The recommended procedure for the WHO cone bioassays was used to expose laboratory-reared, 2- to 5-day-old mosquitoes on sprayed walls. Mortality rates were recorded after a 24-hour recovery period to assess the quality of spraying. Since AIRS Angola does not have

access to a susceptible mosquito colony, the team collected larvae and pupae from the field and reared them to adulthood in the insectary.

Larval collection was conducted in seven villages in the Municipality of Bailundo: Samora, Candandi, Bunju, Bairro Hospital, Velha Chica, Val Verde and Chitalela. Susceptibility tests were conducted using 60 mosquitoes from these localities in May 2013. The result indicated full susceptibility of the vector to deltamethrin. Mosquito larvae and pupae were collected from aquatic habitats using the tray method (Service 1993). Mosquito larvae were sorted into *Anopheles* and culicines by the presence of the siphon. *Anopheles* larvae were then picked up with a pipette, placed into a 50ml Falcon tube, transferred to a big bottle and transported back to the insectary, where they were sorted based on their stage.

In the insectary, rearing was conducted using water from the aquatic habitats from which larvae were collected. In order to avoid fungus/bacteria formation, the water was changed every two to three days. The larval trays were in a room where the temperature did not go under 25°C, and the emergent cages were kept in a room where the temperature didn't exceed 30°C, and relative humidity was between 65 and 75%. The pupae were removed daily and kept in emergent cages until they emerged. Then they were taken to the field and used to test newly sprayed walls on a monthly basis.

The standard WHO cone assay was used to evaluate the quality of spraying and subsequently monitor the residual life of the sprayed insecticide at selected surface heights of 0.5 meters, 1.0 meters, 1.5 meters, and 2.0 meters.

A combination of *An. gambiae* s.l. and *An. coustani* were used for the cone bioassay tests. At time T0, 55 *An. coustani* and 95 *An. gambiae* s.l. were used, at T1, 45 *An. coustani* and 255 *An. gambiae* s.l. were used, and at T2, 15 *An. coustani* and 135 *An. gambiae* s.l. were used. The numbers of mosquitoes dead after a 30-minute exposure to deltamethrin-sprayed walls and a 24-hour holding period are described in Table 15 below. The test mortality rates were 97%, 85% and 54% at time T0, T1 and T2, respectively (Table 15 and Figure 3). The higher survivorship of the exposed mosquitoes at T1 and T2 could possibly be explained by a combination of factors that include insecticide decay, spray quality, and decreased susceptibility of the vector to the sprayed insecticide.

Experience from the other AIRS countries has also shown early decline in test mortality rates when wild mosquitoes of a certain degree of resistance are used for the cone bioassay, as compared to a susceptible colony. Based on these previous observations, higher test mortality rates might have been observed if a fully susceptible mosquito colony was used.

TABLE 14: CONE BIOASSAY TESTING FROM OCTOBER (T0) – DECEMBER 2013 (T2)

Area	Testing Period	# of Houses Tested	# of Mosquitoes Tested	# of Mosquitoes Dead	% Observed Mortality	% Corrected mortality
Huambo	T0 (within two weeks of spraying)	5	150	146	97%	No difference between the observed and corrected mortality
	T1 (one month after spraying)	10	300	256	85%	
	T2 (two months after spraying)	5	150	81	54%	

FIGURE 3: CONE BIOASSAY TEST RESULTS OF *AN. GAMBIAE* S.L., BY NUMBER OF MOSQUITOES EXPOSED AND NUMBER DEAD AFTER 24- HR. HOLDING PERIOD AT T0, T1 AND T2

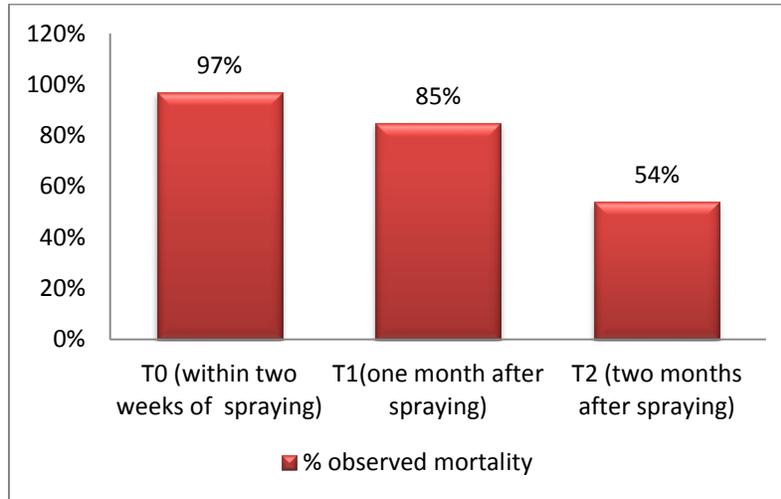


Figure 4: A/ Entomology technician introducing *Anopheles* mosquitoes into the WHO cone using aspirator B/ Technicians waiting for the 30-minute exposure period to remove the exposed mosquitoes C/ Transferring mosquitoes into the holding paper cups



7. MONITORING & EVALUATION

7.1 KEY OBJECTIVES AND APPROACH

The AIRS Angola monitoring and evaluation system drew strengths from the lessons learned and best practices from previous spray campaigns in Angola and in other AIRS countries. As outlined in the 2013 work plan, the AIRS Angola M&E approach is as follows:

- Emphasize accuracy of both the data collection and the data entry processes through comprehensive training and supervision at all levels.
- Streamline and standardize data flow to minimize errors and facilitate timely reporting.
- Ensure IRS data security and storage for future reference, through the establishment and enforcement of proper protocols.
- Document lessons learned and best practices observed during project implementation and apply to future IRS campaigns.

7.2 DATA COLLECTION AND MANAGEMENT

AIRS Angola incorporated all M&E protocol updates, including improvements to the data collection tools and AIRS Access database, before the start of mobilization and spray operations to facilitate high-quality data collection and management and IRS campaign results. The M&E team used the Access database to track campaign progress and seasonal staff performance, and generate “real-time” reports to provide immediate feedback to field staff to resolve issues and inform spray operations.

All data collection was preceded by training of AIRS Angola staff, government supervisors, mobilizers, spray operators, data clerks, and M&E assistants. Mobilizers and spray operators recorded household data on the approved, paper-based data collection tools. (In Bailundo Capital, however, spray operators used smartphones to collect data. Please see 7.8, e-Mobile Data Collection and Verification Pilot, for more detail about AIRS Angola’s e-mobile pilot.) Data clerks performed a final check of the data and arithmetic before entering information into the database. The database and M&E managers examined the data entered for errors and addressed issues with field and data center staff, as appropriate. Spray data were delivered and entered into the database within 72 hours post-spray for quality control purposes and timely generation of weekly spray reports (i.e., no more than 48 hours for delivery and 24 hours for entry). Data center staff filed and archived all data collection forms by date and team number for easy retrieval. At the close of the Huila data center, data collection forms were transmitted and stored in Huambo. The M&E assistants performed a daily electronic back-up to the AIRS Angola cloud-based server to sync the data from all three data centers into one master file. The M&E assistants also saved the master dataset to an external hard drive for data safety and storage.

7.3 DATA CENTER OPERATIONS AND DATA ENTRY

AIRS Angola hired 10 data entry clerks to enter mobilization and spray *totals* and *details* data for the three provinces. AIRS Angola contracted three M&E assistants, one for each province, to strengthen supervision by overseeing data clerks and performing data verification in the field and at the data centers. AIRS Angola set up two data centers for the 2013 spray campaign,

one in Huila and the other in the Huambo central office, and tasked the Cunene M&E assistant to collect, scan and submit mobilization and spray data collection forms to the Huambo data center through the cloud-based server. The Huambo data center was staffed with additional data clerks to verify and enter the Cunene data. We used the same computers from the 2012 campaign, and procured 10 additional computers, including three SQL servers and seven for M&E assistants and data entry clerks. All computers were installed with the most recent version of the AIRS Access database and the new IRS Cleaner/Reporter.

Following last year's protocol, data clerks entered data at two stages: (1) by *totals* for quick reporting and feedback, and (2) by *details* for quality control purposes. Data clerks entered data into their individual database that was linked to the SQL server, or shared database "backend," for all data clerks.

7.4 DATA QUALITY ASSURANCE AND QUALITY CONTROL

During the 2013 IRS campaign, AIRS Angola introduced and implemented the AIRS M&E Supervisory Tools to conduct daily data collection and data entry verification and to scale-up supervision and accountability of seasonal staff. We describe each tool's purpose and the staff responsible for completing the tools here. Annex 1 provides a summary of the supervisory tools used by AIRS Angola.

- Error Eliminator (EE) for mobilization and spray data: Team leaders, supervisors, provincial coordinators and AIRS supervisory staff (M&E assistants, M&E manager, database manager, CoP, operations manager) used the EE, while in the field, to verify that mobilizer and spray data collection tools were completed fully and correctly. The EE highlights common errors found in previous IRS campaigns to make it easier for supervisory staff to identify and reconcile issues, where necessary.
- Data Collection Verification (DCV) Form: Supervisors, field officers, provincial coordinators and AIRS supervisory staff used the DCV form to check the accuracy of the spray data collected by spray operators. To do this, staff visited households to record the spray status on the DCV form and crosschecked that information with the Daily Spray Operator Forms.
- Data Entry Verification (DEV) Form: The M&E assistant and M&E and database managers used the DEV form to check data entry accuracy and data clerk performance.

7.5 DATABASE QUALITY CONTROL AND DATA CLEANING

As in previous spray campaigns, Abt Associates' Client Technology Center (CTC) programmed the Access database with audit checks and data locks to reduce the number of data entry errors. In 2013, CTC introduced SQL Servers (i.e., a connected database "backend") to sync data clerk computers, avoid duplicate structure entries and increase speed of processing large amounts of data. This year, CTC also developed the IRS Reporter/Cleaner in order for data entry clerks and M&E staff to reconcile data on a daily basis. The IRS Reporter/Cleaner specifically identified discrepancies between *totals* and *details*, duplicate data entries, missing records, and data entry errors. As a result, data clerks needed only 12 days to reconcile mobilization and spray data after the 2013 spray campaign. Data clerks and M&E staff also used the IRS Reporter/Cleaner to generate local progress reports by province, as needed. As noted above, supervisory staff also used the Data Entry Verification (DEV) Form to spot-check data entered and to monitor data entry clerk performance. Use rates for the DEV form are listed in Annex 1.

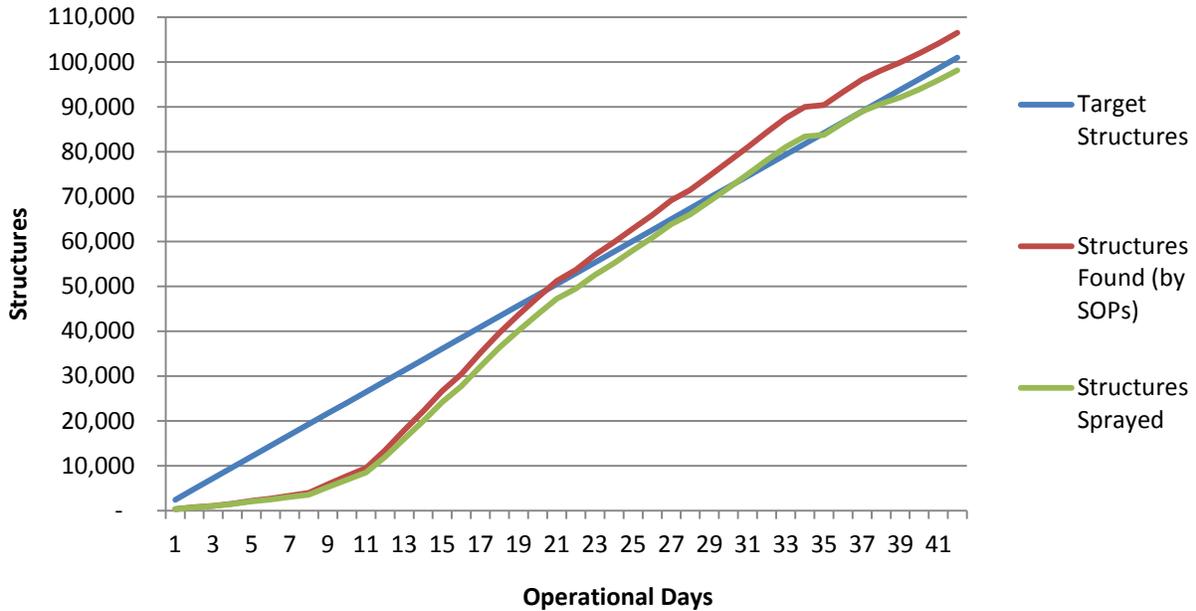
7.6 2013 CAMPAIGN RESULTS

During the 2013 IRS campaign, AIRS Angola sprayed 98,136 of the 106,515 structures found by spray operators, resulting in 92.1% spray coverage. AIRS Angola protected a total of 419,353 people, including 23,459 pregnant women and 74,542 children under five years old. Table 17 provides a summary of the 2013 Angola spray campaign, highlighting core PMI indicators, and Figure 4 depicts the daily spray progress over the course of the campaign.

TABLE 15: SUMMARY OF SPRAY RESULTS: 2013 AIRS ANGOLA CAMPAIGN

Province	Structures Found	Structures Sprayed	Spray Coverage	Population Protected						
				Population Protected	Males Protected	Females Protected	Pregnant Women	Children <5 Years	Population Not Protected	% Population Protected
Cunene	16,533	15,672	94.8%	66,545	32,986	33,559	3,538	12,419	3,715	94.70%
Huambo	15,234	14,227	93.4%	57,921	28,726	29,195	1,491	12,320	1,091	98.20%
Huila	74,748	68,237	91.3%	294,887	147,502	147,385	18,430	49,803	19,933	93.70%
Total	106,515	98,136	92.1%	419,353	209,214	210,139	23,459	74,542	24,739	94.40%

FIGURE 5: AIRS ANGOLA DAILY PERFORMANCE TRACKER



7.7 INSECTICIDE USE AND SPRAY OPERATOR PERFORMANCE

AIRS Angola used 42,856 insecticide sachets to spray 98,136 structures. No full sachets were lost or damaged except one used (empty) sachet was unaccounted for in Cunene. On average, one sachet covered an average of 2.3 structures (Table 18). Spray operators used an average of 4.7 sachets per day to spray an average of 10.8 structures across the three provinces. Data on insecticide stocks and use, and SOP performance, are presented in Tables 18 and 19.

TABLE 16: INSECTICIDE SACHET STOCK

Item	Unit of measure	Initial inventory	Used	Wastage/Loss (Full Sachets)	Stock balance
Insecticide	Sachets	67,198	42,856	0	24,342 ⁵

TABLE 17: Spray Operator Performance and Insecticide Use

Province	Spray operators worked	Structures sprayed	Sachets used	Structures sprayed/ sachets	Structures sprayed/ SOP/day
Cunene	1,789	15,672	5,975	2.6	8.8
Huambo	1,820	14,227	6,007	2.4	7.8
Huíla	5,473	68,237	30,874	2.2	12.5
Total/ Avg	9,082	98,136	42,856	2.3	10.8

⁵ Warehouse has 14 sachets more than M&E database. We based our insecticide figures on operations team data, which uses the initial count at the sites with a final physical count/verification.

7.8 E-MOBILE DATA COLLECTION AND DATA VERIFICATION PILOT

During the 2013 spray campaign, AIRS Angola piloted an e-mobile data collection and verification system as an alternative to the standard, paper-based data collection and quality assurance tools in Bailundo Capital, a commune in Huambo province, Bailundo Municipality (~15,000 targeted structures.) Given the advantages of using mobile data collection applications (i.e., “real-time” data accessibility, elimination of data center, data entry clerk and data transport costs, etc.), we provide the results of the e-mobile pilot and examine the implementation and feasibility of using e-mobile data collection and verification in a low-capacity setting for an IRS campaign.

7.8.1 TRAINING

CTC’s lead trainer, Jeanne Goodman, traveled to Angola to provide an informal one- to two-day ToT training for the M&E manager, database manager and IT Specialist (“M&E/IT team”) on the data collection and data verification protocol and the use of the mobile phones and tablets. The week before spray, the M&E/IT team and Ms. Goodman trained 48 spray operators, eight team leaders and three supervisors for three days on the general use of phones and tablets, and how to record, edit, verify and submit data to the M&E cloud-based server. The AIRS home office developed all training slides and materials and translated them into Portuguese. After observing trainee capabilities during practical sessions, AIRS Angola reassigned the 12 spray operators with the lowest e-mobile capacity to using paper-based collection forms, supporting the Bimbe commune, as their total number of spray operators was low. Upon the return of these operators to Bailundo, they continued to record spray data on the paper-based tools.

7.8.2 SMARTPHONE SET-UP AND INVENTORY MANAGEMENT

PHOTO 1



CTC ordered all phones and tablets and programmed them into Portuguese before shipping to Angola. Once in Angola, the M&E/IT team marked each phone and tablet with an identification number and assigned one to each operator (or team leader) for the same use every day. Phones were safeguarded with a rubber case and a screen protector and operators carried phones in the upper-breasted zipped overall pocket (Photo 1). Spray operators and team leaders used styluses to record data on the phones and tablets while wearing spray gloves.

An inventory storage box was sketched for the phones and tablets; this box was outsourced and built by a local carpenter (Photo 2). The carpenter constructed three storage boxes, one for each brigade in Bailundo Capital.

PHOTO 2: Inventory Storage Box



Each column in the box represents a team and each phone and tablet was designated its own slot that had been labeled with the corresponding identification number. The box was built to ideally position the phones for overnight charging.

Management

Spray return phones box each day recorded equipment phone or campaign.

AIRS Angola to contract Unitel's plan offered maximum of

outgoing calls to non-team contacts. The M&E/IT team programmed the phones and tablets with speed-dial for communication among the teams and with the IT Specialist. The average data cost per phone for the campaign was \$35USD.



Photo 3: Queues for Inventory

operators queued to receive and to the assigned slot in the storage while a supervisory staff person inventory status (Photo 3). All was tracked successfully and no tablet was stolen or lost during the

7.8.2.1 DATA COVERAGE

bought unlocked phones to allow us with any service carrier and selected “Plano Boss” as our data plan. The free calls among teams, with a 20 contacts per team and restricted

7.8.3 DATA COLLECTION AND DATA VERIFICATION

AIRS Angola used an Open Data Kit (ODK) software on the phones to record spray data. ODK was chosen because of its ability to be programmed to prevent skipping mandatory fields and avoid common errors made on paper forms. ODK allows spray operators to scroll back and forth through the forms, and edit data before they submit the forms to the M&E cloud-based system.

A total of 36 spray operators were provided with smartphones to record household spray data. Spray operators were instructed to complete one electronic spray operator form per day, with data recorded by structure, and to submit the finalized form at the end of the day to the “cloud.” After four days of close supervision during spray operations, the M&E/IT team switched nine spray operators from smartphone to paper-based data collection because they still had trouble saving and submitting data. Overall, 27 spray operators used smartphones to collect spray data during the campaign.

Eight team leaders used tablets to verify their team data at the end of the day, but before spray operators left the operations site. Once the spray data was uploaded onto the server, the team leader opened the tablet and viewed the verification table that listed the key indicators for their spray teams for that day. If any issues were identified in the data, the team leader flagged the spray operator form electronically and noted the issue in a text comment for the M&E Team to correct, as necessary.

7.8.4 DATA CLEANING AND REPORTING

The M&E team downloaded the data and the team leader flags from the “cloud” and reconciled any errors in a master dataset. Having immediate access to the data, along with observations in the field, AIRS Angola identified high refusal rates quickly in two villages. AIRS Angola deployed a mobilization unit the next day to circulate in the specific villages and surrounding neighborhoods with loudspeaker IEC messaging. As a result, IRS acceptance rates improved in these areas.

For the weekly spray progress and end of spray reports, the M&E team used an Access-based query programmed by CTC to export the master e-mobile dataset and arrange the data in the same reporting format as the Access data for easy compilation of both datasets.

7.8.5 LESSONS LEARNED AND RECOMMENDATIONS

Overall, the AIRS Angola e-mobile data collection and data verification pilot was successful and provided AIRS staff and CTC with a strong foundation to adjust and improve the system for future spray campaigns. AIRS Angola provides the following successes, lessons learned, and suggested recommendations based on the Angola experience that would improve our current e-mobile system:

Successes

- Built technical capacity in 27 staff with fairly low education levels
- Real-time data was available for reporting and feedback
- All data were captured and summarized successfully; no lost data
- Mobile data plan controlled airtime use and facilitated easy communication among teams
- Upheld AIRS M&E supervisory and data verification system
- Established a foundation for e-mobile data collection to improve upon
- Organized a successful inventory system; no stolen or lost equipment

Lessons Learned

- Low literacy prolonged training and hands-on supervision
- *Recommendation:*
 - Pilot in AIRS countries with higher education levels and capacity.
 - Employ basic mobile phones (i.e., standard Nokia) with sim card application versus touchscreen smartphones.
 - Budget for longer training time and more hands-on exercises.
 - Use an alphabetical keyboard versus QWERTY keyboard.
- Piloted in a new IRS area and with seasonal personnel new to IRS
- *Recommendation:*
 - Implement in target area(s) with a history of IRS.
- Data submitted by spray operator form versus structure
Recommendation:
 - Program software to allow spray operators to submit data after every structure. Team leaders can then validate data throughout the day, instead of at the end of each day.
 - Collect GPS units at the structure level compared to spray form (or village) level, to more closely monitor refusals and spray coverage.
- Technological “bugs” in team leader verification system the first week of spray (i.e., filtering and sorting difficulties)
Recommendation:

- Task team leaders with validating data on basic mobile phones with a sim card application system.
- Develop and test a new, functional data aggregate and cleaning system, incorporating lessons learned with the current system.
- Include the AIRS Angola IT specialist on the development of the system earlier in the process.

8. CAPACITY-BUILDING

Capacity-building is an ongoing, slow process in Angola after nine years of IRS implementation in the country. Results of the initial capacity-building assessment carried out by AIRS Angola in May 2013 reflected limited existing capability and capacity for IRS within the MoH at the national, provincial and municipal levels across all technical areas. In discussions between the Abt home office, the AIRS Angola CoP, PMI Angola and the COR teams, it was agreed to table the IRS capacity assessment for the time being. There has been no official decision regarding next steps and a possible presentation of the assessment results to the host government.

9. CHALLENGES, LESSONS LEARNED, AND RECOMMENDATIONS

9.1 CHALLENGES

The main challenges experienced during the 2013 spray campaign included:

- Loss of IRS household Cards from the 2012 spray campaign, which meant increased costs for reprinting these.
- Community and traditional leaders' lack of participation during the community mobilization and spray campaigns, largely due to demanding duties within their communities, led to insufficient mobilization in many communities. This in turn led to poor adherence to and acceptance of IRS.
- Absence of household heads during the spray campaign, particularly in the Bailundo communes, including Bailundo Capital, Hengue and Bimbe, due to farming responsibilities.
- Other MoH activities taking place at the same time as the campaign; provincial and municipal malaria and other focal points were needed for these other MoH activities, leaving a gap for IRS. Better planning and coordination by the MoH is needed.
- Limited entomological capability, and the distance between the provinces, made consistent entomological monitoring impossible.
- The political divide in Bailundo affected community adherence and acceptance of IRS.
- Initial low IRS coverage in three districts was worrisome, but more mobilizers and packers were hired and the campaign was extended for re-visits, which ensured much improvement in the coverage rates.
- Some households were reluctant to take out their household items, especially in the peri-urban areas.

9.2 LESSONS LEARNED AND RECOMMENDATIONS

- Enhanced supervision by the AIRS Angola team and regular feedback meetings were instrumental to the high spray coverage recorded, and reduced the number of operational days; this approach should be replicated in future efforts.
- Conduct training specifically for IRS focal persons at provincial and municipal levels in order to strengthen their knowledge of IRS operations, supervision and reporting. Such training should be conducted prior to micro-planning to best prepare government personnel.
- The number of IEC mobilizers recruited at the village level should depend on the number of structures in the village and the geographic distribution of structures.
- Angolan women are breaking barriers by leading the fight against malaria through the implementation of Indoor Residual Spraying, traditionally dominated by men in most

countries. Greater involvement of women in IRS mobilization and spraying can be achieved by assigning these functions to women within their village development committees.

- There is a need for greater capacity-building in environmental compliance, entomology and all other IRS components.
- The multi-functional seasonal personnel approach was cost-effective and an effective method of IRS implementation. Working with the same people throughout a spray season provides more consistency, continuity and ownership.
- Although local ownership in IRS is becoming more visible, we must continue to encourage the local health authorities and NMCP to own IRS components and accept more responsibility, both technically and financially. One example would be to transfer leadership of the ToT for spray operators to PDHs and MDHs.
- In August 2013, AIRS Angola conducted structure enumeration and measurement in the Bailundo Municipality, covering all three communes (Bailundo Capital, Bimbe and Hengue) to prepare for spraying the three targeted communes in the municipality. A total of 21,027 structures eligible for spray were enumerated, which was 4,000 structures fewer than the initial target (25,000) based on the population census provided by Bailundo Repartição Municipal da Saúde (RMS). Nearly 6,000 structures fewer than those enumerated were mobilized/sensitized, due to the farming season where residents were not home to greet mobilizers (locally hired). Below is a snapshot of the spray campaign results which are relatively low and do not reflect the amount of effort which went into this municipality.

Communes	Target Structures	Structures Enumerated	Structures Mobilized	Structures Sensitized	Structures found by SOPs	Structures Sprayed	Operational Days	Population Protected	Pregnant Women	Children Under 5	Structures sprayed per day by SOP	Structures sprayed per Sachet
Bailundo capital	15,000	14,463	11,574	11,158	13,052	12,111	37 days	49,418	1,273	10,538	8.4	2.3
Bimbe	5,000	1886	1,579	1,547	982	958	14 days	4,081	108	870	6.3	2.6
Hengue	5,000	4678	1,790	1,758	1,200	1,158	20 days	4,422	110	912	5.1	2.8
TOTAL	25,000	21,027	14,943	14,463	15,234	14,227		57,921	1,491	12,320	7.8	2.4

Because of the significant challenges encountered in Hengue and Bimbe, noted below, those two communes will not be sprayed in 2014.

Hengue is located about 95 km from Bailundo Capital:

- Dirt road only, very precarious conditions
- Health Post (Posto de Saúde) is located at Hengue downtown (operational area - storage unit and soak pits were set-up here)
- Villages (19) an average 3-5 km from operational area, accessible mostly on foot only

- There is no gas station in Hengue
- All SOPs were locally hired (trained highly illiterate farmers into SOPs)
- No suitable places for lodging - Supervision team (AIRS Angola) traveled from Bailundo Capital to Hengue Daily 6 days per week.
- Beginning of planting season took many villagers away from home for weeks at a time.
- There is no cell phone coverage; AIRS Supervisor used Abt provided Sat Phone
- Only Land Cruisers and Land Rovers reached Hengue, difficulties finding owners willing to drive under road conditions.

Bimbe is located about 55 km from Bailundo Capital:

- Relatively good road to reach Bimbe downtown
- Only 5 local SOPs made the grade; brigade from Bailundo Capital covered Bimbe
- 2 Villages (Ganda and Utende) were not accessible (unless SOPs walked for 7 or 8 hours); hence were handled by the Hengue team (5 km walk)
- Health Post (Posto de Saúde) is located at Bimbe downtown (operational area - storage unit and soak pits were set-up here)
- Villages (11) an average 3-5 km from operational area, most only accessible on foot
- Beginning of planting season took many villagers away from home for weeks at a time.
- There is no cell phone coverage; AIRS Supervisor used Abt provided Sat Phones.

ANNEX 1: USE OF SUPERVISORY TOOLS

Type of Form	AIRS Staff	All Three Provinces		
		# Forms	# Verified	% Verified
EE for Spray Data	Team leaders	5,202	5202	100.0%
	Supervisors	3,990	1332	33.4%
	M&E assistants	2523	378	15.0%
	AIRS SMT	4,740	1644	34.7%
EE for Mobilizer Data	Team leaders	1,086	1086	100.0%
	Supervisors	1818	396	21.8%
	M&E assistants	1110	174	15.7%
	AIRS SMT	186	36	19.4%
DCV	Supervisors	1,330	358	26.9%
	Field officers	443	89	20.1%
	Provincial coordinator	76	21	27.6%
	M&E assistants	654	52	8.0%
	AIRS SMT	272	67	24.6%
	DPS/RMS	75	20	26.7%
DEV	M&E assistants	259	72	27.8%
	DB manager	245	179	73.1%
	M&E manager	330	254	77.0%

ANNEX 2: ANGOLA MONITORING AND EVALUATION PLAN INDICATOR MATRIX

Performance Indicator	Indicator Definition	Project Year(s) Reporting	Data Source(s) and Reporting Frequency	Dis-aggregated	PMI/AIRS Indicator	Annual Targets and Results					
						Year 1		Year 2		Year 3	
						Target	Result	Target	Result	Target	Result
Component 1: Establish cost-effective supply chain mechanisms including procurement, distribution and storage of IRS-related commodities and execute all aspects of logistical plans for IRS-related activities.											
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>[Numerator: Number of international insecticide procurement orders delivered in country, at port of entry, at least 30 days prior to the start of spray operations]</p> <p>[Denominator: Total number of international insecticide procurement orders]</p> <p>Calculation: [Numerator ÷ Denominator] x 100</p>	Y1, Y2, Y3	<p>Data source: Logistics and Procurement Inventory Reports</p> <p>Reporting frequency: Each spray season</p>	By spray campaign	AIRS	I; 80%	I; 100%	I; 100%	0; 0% ⁶		

⁶ Insecticide arrived at the port of entry before the spray campaign began (24 days prior) but not at least 30 days before spray operators began.

Performance Indicator	Indicator Definition	Project Year(s) Reporting	Data Source(s) and Reporting Frequency	Dis-aggregated	PMI/AIRS Indicator	Annual Targets and Results					
						Year 1		Year 2		Year 3	
						Target	Result	Target	Result	Target	Result
1.1.2 Number and percentage of international procurement orders for equipment, including PPE, received at port of entry, 30 days prior to start of spray operations.	<p>[Numerator: Number of international procurement orders for equipment, including PPE, received at port of entry, 30 days prior to start of spray operations]</p> <p>[Denominator: Total number of international procurement orders for equipment, including PPE]</p> <p>Calculation: $[\text{Numerator} \div \text{Denominator}] \times 100$</p>	Y1, Y2, Y3	<p>Data source: Logistics Inventory Report</p> <p>Reporting frequency: Each spray season</p>	By spray campaign	AIRS	1; 85%	8; 100%	4; 100%	4; 100%		
1.1.3 Number and percentage of local PPE procurement orders that are delivered to the main warehouse, 14 days before the start of spray operations	<p>[Numerator: Number of local PPE procurement orders delivered to the main warehouse 14 days before the start of spray operations]</p> <p>[Denominator: Total number of local PPE procurement orders.]</p> <p>Calculation: $[\text{Numerator} \div \text{Denominator}] \times 100$</p>	Y1, Y2, Y3	<p>Data source: Logistics and Procurement Inventory Reports</p> <p>Reporting frequency: Each spray season</p>	By spray campaign	AIRS	1; 80%	2; 0%	2; 100%	2; 100%		

Performance Indicator	Indicator Definition	Project Year(s) Reporting	Data Source(s) and Reporting Frequency	Dis-aggregated	PMI/AIRS Indicator	Annual Targets and Results					
						Year 1		Year 2		Year 3	
						Target	Result	Target	Result	Target	Result
I.1.4 Successfully completed spray operations without an insecticide stock-out	Milestone: (Completed/Not Completed)	Y1, Y2, Y3	<i>Data source:</i> Logistics Inventory Report <i>Reporting frequency:</i> Each spray season	By spray campaign	AIRS	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	<i>[Numerator:</i> Total number of logistics and warehouse managers trained in IRS supply chain management using AIRS Project resources] <i>[Denominator:</i> Total number of AIRS logistics and warehouse managers] <i>Calculation:</i> [Numerator ÷ Denominator] x 100	Y1, Y2, Y3	<i>Data source:</i> Routine training records <i>Reporting frequency:</i> Each spray season	By spray campaign By gender	AIRS	9; 80%	10; 100% 8 males, 2 females	20; 100% 16 males, 2 females	11; 55% 9 males, 2 females		

Performance Indicator	Indicator Definition	Project Year(s) Reporting	Data Source(s) and Reporting Frequency	Dis-aggregated	PMI/AIRS Indicator	Annual Targets and Results					
						Year 1		Year 2		Year 3	
						Target	Result	Target	Result	Target	Result
1.2.2 Number and percentage of base stores where physical inventories are verified with up-to-date stock records	<p>[Numerator: Number of base stores where physical inventories are verified by up-to-date stock records]</p> <p>[Denominator: Total number of base stores audited]</p> <p>Calculation: $[\text{Numerator} \div \text{Denominator}] \times 100$</p> <p>See PIRS for details on sample size for operational audits)</p>	Y2, Y3	<p>Data source: Logistics and Environmental compliance reports</p> <p>Reporting frequency: Each spray season</p>	By spray campaign	AIRS	80%	3; 100%	6; 100%	5; 83.3%		
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>Data source: Post-Spray Logistics Inventory Report</p> <p>Reporting frequency: Each spray season</p>	By spray campaign	AIRS	N.A.	Not completed ⁷	Completed	Not completed ⁸		

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

2.1 Planning and Design of IRS Programs

⁷ Inventory records were submitted to the home office but more than 30 days post-end of spray.

⁸ Inventory records were submitted to the home office but more than 30 days post-end of spray.

Performance Indicator	Indicator Definition	Project Year(s) Reporting	Data Source(s) and Reporting Frequency	Dis-aggregated	PMI/AIRS Indicator	Annual Targets and Results					
						Year 1		Year 2		Year 3	
						Target	Result	Target	Result	Target	Result
2.1.1 Annual IRS country work plan developed and submitted on time	Milestone: (Completed/Not Completed)	Y1, Y2, Y3	<i>Data source:</i> Project records <i>Reporting frequency:</i> Annually		AIRS	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 ⁹	Milestone: (Completed/Not Completed)	Y1, Y2, Y3	<i>Data source:</i> Project records – submitted SEAs/ letter reports <i>Reporting frequency:</i> Each spray campaign	By spray campaign	AIRS	Completed	Completed	Completed	Completed		
2.2.2 Number and percentage of soak pits and storehouses inspected and approved prior to spraying	[Numerator: Number and percentage of soak pits and warehouses/storerrooms inspected and certified by an environmental officer/AIRS environmental compliance officer prior to each spray campaign supported by the AIRS Project]	Y1, Y2, Y3	<i>Data source:</i> Pre, Mid- and Post-Inspection Reports submitted by environmental officers <i>Reporting frequency:</i> Each spray season	By spray campaign	AIRS	6; 100% 3 soak pits 3 ware-houses	8; 100% 5 soak pits 3 ware-houses	16; 100% 8 soak pits 8 ware-houses	10; 62.5% 5 soak pits 5 ware-houses		

⁹ In Year 1 and Year 2, SEAs were due 30 days prior to the start of spraying and letter reports were to be submitted 14 days prior to the start of spraying. In Year 3, due dates will be agreed upon with PMI-Washington and will be noted in each country-specific MEP to assess indicator 2.2.1.

Performance Indicator	Indicator Definition	Project Year(s) Reporting	Data Source(s) and Reporting Frequency	Dis-aggregated	PMI/AIRS Indicator	Annual Targets and Results					
						Year 1		Year 2		Year 3	
						Target	Result	Target	Result	Target	Result
	[Denominator: Total number of project soak pits and/or storehouses] Calculation: $[\text{Numerator} \div \text{Denominator}] \times 100$										
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: Training reports from environmental compliance officer Reporting frequency: Semi-annually	By spray campaign By gender	AIRS	48	42; 10 males, 32 females	45; 9 males, 36 females	24; 15 males, 9 females		
2.2.4 Number of spray personnel trained in environmental compliance and personal safety standards in IRS implementation	Total number of spray personnel who attend a training in environmental compliance and personal safety standards in IRS implementation using AIRS Project resources, includes all staff who received environmental compliance training – spray operators, team leaders, washpersons, storekeepers, etc.	Y1, Y2, Y3	Data source: Project records – Training reports Reporting frequency: Each spray season	By spray campaign By gender	AIRS	1,287	762; 480 males, 282 females	575; 350 males, 225 females	716; 441 males, 275 females		

Performance Indicator	Indicator Definition	Project Year(s) Reporting	Data Source(s) and Reporting Frequency	Dis-aggregated	PMI/AIRS Indicator	Annual Targets and Results					
						Year 1		Year 2		Year 3	
						Target	Result	Target	Result	Target	Result
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	<i>Data source:</i> Project records – Training reports <i>Reporting frequency:</i> Each spray season	By spray campaign By gender	AIRS	45	42; 10 males, 32 females	45; 9 males, 36 females	24; 15 males, 9 females		
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	<i>Data source:</i> Incident report forms that are required for each incidence of pesticide exposure <i>Reporting frequency:</i> Each spray season	By spray campaign By residential/ occupational exposure	AIRS	0	0	0	0		
2.2.7. Number of vehicular accidents reported	Total number of vehicular accidents reported	Y1, Y2, Y3	<i>Data source:</i> Vehicular incident report forms that are required for each accident <i>Reporting frequency:</i> Each spray season	By spray campaign	AIRS	0	0	0	0		

2.3 Support Entomological Monitoring Activities and Insecticide Resistance Strategies

Performance Indicator	Indicator Definition	Project Year(s) Reporting	Data Source(s) and Reporting Frequency	Dis-aggregated	PMI/AIRS Indicator	Annual Targets and Results					
						Year 1		Year 2		Year 3	
						Target	Result	Target	Result	Target	Result
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	<i>Data source:</i> Entomological reports <i>Reporting frequency:</i> Annually	By spray campaign	AIRS	18	22	23 ¹⁰ 9 Huambo 7 Huila 7 Cunene	7		
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> $[\text{Numerator} \div \text{Denominator}] \times 100$	Y1, Y2, Y3	<i>Data source:</i> Entomological reports <i>Reporting frequency:</i> Annually	By spray campaign	AIRS	N.A.	1; 100%	3; 100%	5; 100%		
2.3.3 Number and percentage of entomological monitoring sentinel 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> $[\text{Numerator} \div \text{Denominator}] \times 100$	Y1, Y2, Y3	<i>Data source:</i> Entomological reports <i>Reporting frequency:</i> Annually	By spray campaign	AIRS	N.A.	N.A.	0; 0%	0; 0%		

¹⁰

Year 2 target of 23 included 9 sentinel sites in Huambo; 1 each in Hengue and Bimbe and 7 in Bailundo Capital. Targets also included 7 each of the provinces of Huila and Cunene), however Ento Monitoring only was carried out in Huambo, more specifically in Bailundo Capital.

Performance Indicator	Indicator Definition	Project Year(s) Reporting	Data Source(s) and Reporting Frequency	Dis-aggregated	PMI/AIRS Indicator	Annual Targets and Results					
						Year 1		Year 2		Year 3	
						Target	Result	Target	Result	Target	Result
2.3.4 Number and percentage of insecticide resistance testing sites that tested at least one insecticide from each of the four classes of insecticides recommended for malaria vector control	[Numerator: Number of insecticide resistance testing sites that tested at least one insecticide from each of the four classes of insecticides recommended for malaria vector control] [Denominator: Number of insecticide resistance testing sites] Calculation: [Numerator ÷ Denominator] x 100	Y1, Y2, Y3	Data source: Entomological reports Reporting frequency: Annually	By spray campaign By type of insecticide	AIRS	1; 85%	3; 100%	2; ¹¹ 100%	2; 100%		
2.3.5 Number of wall bioassays conducted within 2 weeks of spraying to evaluate the quality of IRS	Total number of wall bioassay studies conducted in established sentinel sites to evaluate quality of IRS spraying activities	Y1, Y2, Y3	Data source: Entomological reports Reporting frequency: Per spray campaign	By spray campaign	PMI	14	13	19	5 ¹²		
2.3.6 Number of wall bioassays conducted after the completion of spraying at monthly intervals to evaluate insecticide decay	Total number of wall bioassay studies conducted at monthly intervals in established sentinel sites to evaluate the rate of insecticide decay on sprayed surfaces	Y1, Y2, Y3	Data source: Entomological reports Reporting frequency: Per spray campaign	By spray campaign	PMI	5	14	19	5		

¹¹ Conducting in Huila and Huambo only in Year 2.

¹² Lack of human resources made it impossible to meet the target.

Performance Indicator	Indicator Definition	Project Year(s) Reporting	Data Source(s) and Reporting Frequency	Dis-aggregated	PMI/AIRS Indicator	Annual Targets and Results					
						Year 1		Year 2		Year 3	
						Target	Result	Target	Result	Target	Result
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	<i>Data source:</i> Entomological reports <i>Reporting frequency:</i> Per spray campaign	By spray campaign By type of insecticide	PMI	14	3	2	2		
2.4 Conduct Communications Activities and Community Mobilization											
2.4.1 Number of radio spots and talk shows aired	Total number of radio spots and talk shows aired in target spray districts to stress the safety and benefits of IRS, ensure successful spray coverage, timely vacating of premises and adherence to IRS safety precautions by community members	Y1, Y2, Y3	<i>Data source:</i> Project records <i>Reporting frequency:</i> Semi-annually	By spray campaign	AIRS	200	185	150	80	55 radio spots; 25 radio shows	
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	<i>Data source:</i> Project records <i>Reporting frequency:</i> Semi-annually	By spray campaign By Type of printed material and message(s)	AIRS	200,000	188,035	150,000	41,804	400 posters, 6 banners, 38,738 IRS brochures, 1,300 T-shirts, 1,000 caps, 360 PMI stickers	

Performance Indicator	Indicator Definition	Project Year(s) Reporting	Data Source(s) and Reporting Frequency	Dis-aggregated	PMI/AIRS Indicator	Annual Targets and Results					
						Year 1		Year 2		Year 3	
						Target	Result	Target	Result	Target	Result
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	148,725	304,651	300,000	221,688 97,954 males, 123,734 females		
2.5 Spray Targeted Structures According to Technical Specifications											
2.5.1 Number of structures targeted for spraying	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	136,000	145,107	101,000	106,515		
2.5.2 Number of structures sprayed with IRS	Total number of sprayed structures in targeted districts where spraying was conducted	Y1, Y2, Y3	Data source: Daily Spray Operator Forms Reporting frequency: Daily per spray campaign	By spray campaign	PMI	115,600	141,782	85,850	98,136		
2.5.3 Percentage of total structures targeted for spraying that were sprayed with a residual insecticide (Spray Coverage)	[Numerator: Total number of structures sprayed in targeted districts] [Denominator: Total	Y1, Y2, Y3	Data source: Daily Spray Operator Forms Reporting	By spray campaign	PMI	85%	97.7%	85%	92.1%		

Performance Indicator	Indicator Definition	Project Year(s) Reporting	Data Source(s) and Reporting Frequency	Dis-aggregated	PMI/AIRS Indicator	Annual Targets and Results					
						Year 1		Year 2		Year 3	
						Target	Result	Target	Result	Target	Result
	number of structures in targeted areas found by spray operators] Calculation: [Numerator ÷ Denominator] x 100		frequency: Daily per spray campaign								
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 Pregnant women By Children <5 years	PMI	650,000	676,090; 37,049 pregnant women, 115,678 children <5	500,000; 27,399 pregnant women, 85,549 children <5	419,353; 23,459 pregnant women, 74,542 children <5		

Component 3: Provide ongoing monitoring and evaluation and quality control measures.

3.1 Submit Monitoring and Evaluation Plan (MEP) to PMI-Angola	Milestone: (Completed/Not Completed)	Y1, Y2, Y3	Data source: Project records Reporting frequency: Semi-annual		AIRS	Completed	Completed	Completed	Completed		
3.2 Submit a post-spray data quality audit report to the M&E Specialist in the AIRS Home Office within 60 –180 days of completion of spray operations	Milestone: (Completed/Not Completed)	Y1, Y2, Y3	Data source: Spray Data Quality Report Reporting frequency: Per spray campaign	By spray campaign	AIRS	N.A.	N.A.	Completed	In process		
3.3 Submit a country-specific Eligible Structure Definition Document to	Milestone: (Completed/Not Completed)	Y1	Data source: Project records		AIRS	Completed	Completed	N.A.	N.A.	N.A.	N.A.

Performance Indicator	Indicator Definition	Project Year(s) Reporting	Data Source(s) and Reporting Frequency	Dis-aggregated	PMI/AIRS Indicator	Annual Targets and Results					
						Year 1		Year 2		Year 3	
						Target	Result	Target	Result	Target	Result
local PMI advisors and NMCP			<i>Reporting frequency:</i> Semi-annually								
3.4 Supply chain review conducted by RTT	Milestone: (Completed/Not Completed)	Y1, Y2	<i>Data source:</i> RTT supply chain review reports <i>Reporting frequency:</i> Semi-annually	By spray campaign	AIRS	N.A	1	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	<i>Data source:</i> Project records – Activity reports <i>Reporting frequency:</i> Semi-annually	By guideline/checklist/tool	AIRS	N.A	21	16 ¹³	18 ¹⁴		
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	<i>Data source:</i> EOSR <i>Reporting frequency:</i> Semi-annually	By spray campaign By IRS Technical Area	AIRS	N.A.	0	1	0		

¹³ Tools include checklists for environmental compliance (3), mobilization (5), spray operations (3), and logistics (3), and 2 M&E standard operating procedures.

¹⁴ Tools include checklists for environmental compliance (6), mobilization (3), spray operations (5), logistics (2), and (2) M&E standard operating procedures.

Performance Indicator	Indicator Definition	Project Year(s) Reporting	Data Source(s) and Reporting Frequency	Dis-aggregated	PMI/AIRS Indicator	Annual Targets and Results					
						Year 1		Year 2		Year 3	
						Target	Result	Target	Result	Target	Result
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	<i>Data source:</i> Project records – Activity reports <i>Reporting frequency:</i> Semi-annually	By IRS Technical Area	AIRS	N.A.	10 ¹⁵	6	9		

Component 5 (Cross-cutting): Capacity-building, knowledge transfer, gender inclusion.

5.1 Capacity-Building (Gender Inclusion)											
5.1.1 Number of people trained in IRS implementation	Total number of personnel trained in IRS implementation using AIRS Project resources. This figure only includes spray personnel such as spray operators, team leaders, supervisors, clinicians.	Y1, Y2, Y3	<i>Data source:</i> Project records – Training reports <i>Reporting frequency:</i> Semi-annually	By spray campaign By gender Percentage of women trained	PMI	800	691; 435 males, 256 females 37% of women trained	470; 291 males, 179 females 38% of women trained	671; 413 males, 258 females 38.5% of women trained		
5.1.2 Number of people trained to deliver or support IRS in target districts	Total number of people trained using AIRS Project resources to implement/support elements of IRS in target districts. This figure includes all cadres that serve a role in IRS.	Y1, Y2, Y3	<i>Data source:</i> Project records – Training reports <i>Reporting frequency:</i> Semi-annually	By spray campaign By gender By role (e.g., spray operator, storekeeper) Percentage of women trained	AIRS	1,287	1,203; 734 males, 469 females 39% of women trained	810; 486 males, 324 females 40% of women trained	870; 537 males, 333 females 38.3% of women trained		

¹⁵ Presentations covered topics in entomology (3), environmental compliance (3), and IRS in general (4).

Performance Indicator	Indicator Definition	Project Year(s) Reporting	Data Source(s) and Reporting Frequency	Dis-aggregated	PMI/AIRS Indicator	Annual Targets and Results					
						Year 1		Year 2		Year 3	
						Target	Result	Target	Result	Target	Result
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	<i>Data source:</i> Project records – Training reports <i>Reporting frequency:</i> Semi-annually	By spray campaign By gender Percentage of women trained	AIRS	225 ¹⁶	40; 25 males, 15 females 38% of women trained	25; 15 males, 10 females 39% of women trained	29; 21 males, 8 females 27.6% of women trained		
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	<i>Data source:</i> Project records – Training reports <i>Reporting frequency:</i> Semi-annually	By spray campaign By gender Percentage of women trained Type of government official	AIRS	10	42; 10 males, 32 females 76% of women trained Type: Health clinicians	45; 9 males, 36 females 80% of women trained Type: Health clinicians	24; 15 males, 9 females 37.5% of women trained Type: Health clinicians		
5.1.5 AIRS conducted a capacity assessment	AIRS Angola program conducted an assessment of IRS capacity among national and sub-national/district government health officials	Y1, Y2	<i>Data source:</i> Project records – Capacity assessment reports <i>Reporting frequency:</i> Semi-annually		AIRS	Completed	In process	Completed	Inconclusive		
5.1.6 Number of capacity-building MOUs signed by AIRS, NMCP and partners/	Total number of Memoranda of Understanding (MOU)	Y1, Y2, Y3	<i>Data source:</i> Project records –	By spray campaign	AIRS						

¹⁶ The Year 1 target was misestimated and not established based on PMI's definition.

Performance Indicator	Indicator Definition	Project Year(s) Reporting	Data Source(s) and Reporting Frequency	Dis-aggregated	PMI/AIRS Indicator	Annual Targets and Results					
						Year 1		Year 2		Year 3	
						Target	Result	Target	Result	Target	Result
institutions	on provision of local capacity-building finalized and signed between AIRS, the Malaria and Other Parasitic Diseases Division (MOPPD), and other local partners and institutions		MOUs <i>Reporting frequency:</i> Semi-annually								