
**PMI | Africa IRS (AIRS) Project**

Indoor Residual Spraying (IRS 2) Task Order Four

# ANGOLA
# END OF SPRAY REPORT 2012

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# ANGOLA
# END OF SPRAY REPORT 2012

# CONTENTS

## LIST OF TABLES



## LIST OF FIGURES

# ACRONYMS

| | |
|---|---|
| **AIRS** | Africa Indoor Residual Spraying |
| **BAI** | *Banco Angolano de Investimentos* |
| **COP** | Chief of Party |
| **DDT** | Dichloro-diphenyl-trichloroethane |
| **ECO** | Environmental Compliance Officer |
| **F&A** | Finance & Administration |
| **IEC** | Information, Education and Communication |
| **IRS** | Indoor Residual Spraying |
| **ITN** | Insecticide-Treated Net |
| **M&E** | Monitoring and Evaluation |
| **NMCP** | National Malaria Control Program |
| **PDH** | Provincial Directorate of Health/Direcção Provincial da Saúde (DPS) |
| **PMI** | President's Malaria Initiative |
| **PPE** | Personal Protective Equipment |
| **QA/QC** | Quality Assurance and Control |
| **RNJCMGE** | National Journalist Network against Malaria and Other Major Diseases |
| **ToT** | Training of Trainers |
| **WHO** | World Health Organization |

# EXECUTIVE SUMMARY

In August 2011, Abt Associates (Abt) was awarded a three-year Africa Indoor Residual Spraying project (AIRS), IRS 2 Task Order 4, funded by the United States Agency for International Development under the President's Malaria Initiative (PMI). The mandate of the project is to limit exposure to malaria and reduce the incidence and prevalence of malaria in up to 17 countries in sub-Saharan Africa. The key objectives of the Angola IRS program are to work with the Ministry of Health, National Malaria Control Program (NMCP), Provincial Directorates of Health (PDH), and other key government stakeholders to reduce malaria-associated morbidity and mortality, by spraying approximately 136,000 structures in the three provinces targeted for IRS, protecting approximately 650,000 residents in the Huambo, Huila and Cunene Provinces.

Abt implemented the 2012 IRS spray campaign working in close collaboration with PMI Angola and the Angolan national, provincial and municipal government authorities. Angola completed its eighth round of IRS under PMI funding for malaria control as part of the National Integrated Vector Control Management Strategy, targeting the provinces of Huambo, Huila and Cunene. The 2012 spray campaign was launched on October 29, 2012 and was completed on December 18, 2012. In Huambo Province, IRS was conducted in Huambo municipality; in Huila, in Lubango and Chibia municipalities; and in Cunene, in Kwanhama and Namakude municipalities, including Santa Clara, which is on the border with Namibia.

The 2012 PMI Malaria Operational Plan included a target of 136,000 structures for IRS Angola: 60,000 in Huambo, 60,000 in Huila, and 16,000 in Cunene. At the end of the 2012 Angola IRS campaign, spray operators had found a reported 145,107 structures, and had sprayed 141,782 structures, resulting in a 97.7% spray coverage. The total population protected during the campaign was 676,090. Of these, 115,678 children under the age of five years and 37,049 pregnant women were protected. A summary table is included below:

| | |
|---|---|
| Number of provinces/districts covered by PMI-supported IRS in 2012 | Three (Huambo, Huila, Cunene) |
| Insecticide | Pyrethroid |
| Number of structures covered by PMI-supported IRS in 2012 | 141,782 |
| Number of structures targeted by PMI-supported IRS in 2012 | 136,000 |
| 2012 spray coverage | 97.7% |
| Population protected by PMI-supported IRS in 2012 | 676,090 |
| Dates of PMI-supported IRS campaign | October 29 – December 18 |
| Length of IRS campaign | 44 operational days |
| Number of people trained with US government funds to deliver IRS[1] | 691 |

[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.

The 2012 IRS campaign consumed a total of 78,207 sachets of deltamethrin insecticide, with an average insecticide use rate of one sachet per 1.8 structures, and an average of 10.2 structures sprayed per spray operator per day.

All 2012 IRS activities were preceded by planning meetings with the national and provincial governments, followed by micro-planning meetings with relevant partners in each of the three provinces and municipalities involved. Operational and logistics needs assessments were undertaken in advance to quantify requirements for the 2012 IRS campaign. An insecticide resistance study was conducted in May 2012, followed by entomological monitoring during and after the spray campaign.

Highlights and key achievements of IRS Angola in 2012 include:

- Established a fully functional central project in Huambo, and provincial satellite offices in Huila and Cunene. The AIRS Angola team has 20 full-time staff members.
- Established critical working relationships with key host country stakeholders, including the NMCP, PDHs, Ministry of Environment, and municipal departments of public health, and other local partners and stakeholders.
- Executed a Memorandum of Understanding with the NMCP agreeing to program objectives and priorities, and outlining national/provincial government and Abt's roles and responsibilities to achieve program objectives.
- Developed a Monitoring and Evaluation (M&E) Access database to ensure the accuracy of both the data collection and the data entry process through comprehensive trainings and supervision at all levels. This database also streamlined and standardized information flow to minimize errors, facilitate timely reporting, and ensure IRS data security and storage for future reference through established protocols.
- Developed a Structure Definition document to provide a general definition of what constitutes a "structure" for a clear understanding of this definition among all AIRS collaborating parties and throughout the AIRS Angola Program.
- Established a working insectary in the central office to support entomological activities, including rearing a mosquito colony for insecticide susceptibility testing; quality assurance of the IRS campaign; insecticide decay rates; and identification of vector to species level.
- Carried out entomological surveillance, including insecticide susceptibility testing, quality and insecticide decay monitoring, and vector behavior studies.
- Trained 12 entomology technicians, and provided them with opportunities to support entomological monitoring activities throughout the year.
- Quantified, procured and ensured timely delivery of all international and local materials, including deltamethrin insecticide, personal protective equipment (PPE), and other materials and supplies required.
- Carried out a pre-spray campaign assessment and rehabilitated the warehouses and operational sites in accordance with World Health Organization (WHO) and PMI environmental compliance best practices for IRS.
- Trained 1,203 people (government and private citizens) in the various components of IRS, including 609 spray operators (400 males and 209 females), 414 community mobilizers and enumerators (238 males and 176 females), 42 health technicians (10 males and 32 females), and 14 data entry clerks (10 males and 4 females).

# 1. BACKGROUND

PMI began supporting indoor residual spraying in Angola in 2005, targeting three southern provinces: Huambo, Huila, and Cunene, based on malaria epidemiology. Malaria transmission is seasonal in the southern provinces, in contrast to stable and intense transmission in the northern part of the country. This means that malaria transmission in the south is of an epidemic type, but more amenable to vector control than in the north.

Historically, Huambo province was the second most malarious province in the country, but in 2012 it had the second lowest number of deaths caused by malaria. Huila reports the most cases of malaria among the southern provinces. Cunene was added to the IRS target provinces in 2010 in response to the NMCP request to support the Southern African Development Community initiative for malaria elimination in Namibia. In August 2012 the Governments of Angola and Namibia signed a Memorandum of Understanding (Initiative Trans-Kunene for Malaria Control) that called for synchronized indoor residual spraying programs along the borders of the two countries. In 2012, Abt conducted a sixth annual spray campaign in Huambo, an eighth in Huila, and a fifth round of spraying in Cunene. Pyrethroids have been the insecticide of choice since 2006 because the Government of the Republic of Angola has banned the use of dichloro-diphenyl-trichloroethane (DDT) and there seems to be no intention of lifting the ban in the near future.

## 1.1 MALARIA SITUATION IN ANGOLA

Malaria is endemic throughout much of Angola, and it is by far the largest cause of morbidity and mortality. With approximately three million cases per year, malaria continues to be a major public health problem in Angola. The disease is responsible for more than 50% of all outpatient visits, 60% of hospital admissions among children under five, 35% of overall mortality in children under five, and around 25% of maternal mortality. From January to October 2010, 6,770 deaths in Angola were attributed to malaria; 8% of those were from Huila and Huambo, and 6% were from Cunene.

In general, the country can be divided into three major malaria epidemiologic zones, or strata: (1) northern regions and the coastal lowlands of the Atlantic Ocean, (2) the highlands of the central and southern provinces, and (3) the southern provinces bordering Namibia. While the northern regions and the coastal lowlands of the Atlantic Ocean experience hyper-endemic transmission, and the highlands of the central and southern provinces experience lower, meso-endemic, unstable transmission, the southern provinces bordering Namibia are epidemic-prone. The peak malaria transmission months are March and April, with a secondary peak in October and November. *Plasmodium falciparum* is responsible for nearly 90% of all malaria infections. The primary vectors in the high transmission areas are *Anopheles gambiae* s.l. and *An. funestus*, which prefer to bite humans and feed and rest indoors. *An. melas*, which favors a brackish water habitat, can be an important vector in coastal areas. *An. pharoensis* can be a secondary vector where present.

## 1.2 Spray Sites

Spray site selection for 2012 was made in collaboration with the Ministry of Health/NMCP and PMI, who agreed to support IRS in the same three provinces that were supported in 2010 and 2011—Huambo, Huila, and Cunene. 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. Site selection was based on the level of the malaria burden, population density, and accessibility.

# 2. PREPARATION FOR IRS

## 2.1 REVIEW OF GEOGRAPHIC RECONNAISSANCE

Geographic reconnaissance was carried out in all three provinces in 2010 by the former PMI contractor; therefore, in discussions with the National Malaria Control Program and the Provincial Directorates of Health, the team agreed that a full geographical reconnaissance was not required to prepare for the 2012 spray campaign. Together with the PDHs, the AIRS Angola team verified data from the previous geographic reconnaissance and spray campaigns to confirm the number and average size of structures, organization of neighborhoods, presence and condition of roads, access to water, and communications suitability. This step is critical to developing the operational plan for the spray campaign. Additionally, the team also established contacts with local authorities to form partnerships and to promote IRS as a malaria intervention, and to solicit community participation throughout IRS planning, training, and implementation.

## 2.2 LOGISTICS NEEDS, INSECTICIDE SELECTION AND PROCUREMENT

A logistics needs assessment was undertaken in April 2012 to identify all logistical inputs required for the 2012 spray campaign. The assessment identified gaps and areas that required further assessment and rehabilitation, vis-à-vis environmental compliance (i.e., warehouses and operational areas). Based on the logistics needs assessment, which took into consideration spray targets, infrastructure and resources, as well as the program inventory inherited from the incumbent, an operational plan was developed in preparation for micro-planning. A procurement plan was also developed, detailing types and quantities of commodities, equipment and supplies needed to cover the 2012 spray campaign.

Based on entomological data from the insecticide susceptibility study conducted in May 2012 and wall bioassays carried out after the 2011 spray round, PMI and the NMCP agreed that a pyrethroid insecticide would be used for the 2012 spray campaign. Insecticide procurement was carried out by public solicitation at the class level by the Abt Associates home office procurement division. After all quotations were reviewed for value and responsiveness to selection criteria, deltamethrin (K-Othrine) was selected and procured. Procurement for selected PPE was managed by the Huambo central office, as was procurement for other necessary supplies and equipment. Local vendors in Angola were sought where possible, though most key items were transferred inventory from the previous contractor or had to be purchased internationally. All international and local procurement was conducted through a competitive tendering process by Abt's home office in Bethesda, MD, or by the central office in Huambo, Angola.

## 2.3 MICRO-PLANNING

Micro-planning was conducted in each of the three provinces in July 2012, in collaboration with the respective PDHs and the municipal departments of public health. The program team facilitated micro-planning meetings, presented a detailed timeline and operational plan for discussion, planned meetings, and worked closely with provincial and municipal departments of public health officials, community leaders and other partners, including the police department, armed forces, churches and the National and Provincial Journalist Network against Malaria and Other Major Diseases (RNJCMGE) in Huambo, Huila and Cunene provinces. The team prepared detailed operational plans and action plans for each province, outlining human resource requirements, selection criteria, training, recruitment of seasonal

personal, and logistics and transportation requirements. The action plan also outlined all spray campaign activities for implementation before, during and after spraying.

## 2.4 PRE-SPRAY ENVIRONMENTAL COMPLIANCE ACTIVITIES

As outlined in the 2012 work plan, there is an existing approved Supplemental Environmental Assessment covering Angola's IRS program from 2010 through 2015, with an option of insecticide from three classes, including organophosphates, carbamates, and pyrethroids. The Letter Report to inform the 2012 IRS campaign was submitted and approved by USAID and PMI Angola in September 2012.

Abt retained the warehouses and operational sites from the former PMI contractor in the three provinces. All three warehouses are located within an IRS targeted municipality, and each warehouse location also serves as the single operational site for its respective province. The Huambo warehouse serves as the central warehouse and is located in the Zona Industrial, Municipality of Caala, about 14 kilometers from downtown Huambo. In the province of Huila, the warehouse is located in the Zona Industrial, about 12 kilometers from Lubango, and in Cunene, the warehouse, which also served as an office for the two-person provincial team, is located in Ondjiva.

In the absence of an experienced Environmental Compliance Officer (ECO) on staff, the team used the technical expertise of the AIRS Ghana Environmental Compliance Officer. In collaboration with the PDHs, the Department of Urban Planning and Environment, which represents the Ministry of Environment, and the newly hired AIRS Angola ECO, the Ghana ECO conducted an environmental compliance assessment of the warehouses and operational sites, to evaluate gaps, improvements, and rehabilitation required to ensure environmental compliance and readiness for the 2012 spray campaign. Table I below reflects findings and recommendations for improvements and rehabilitation of the warehouses and operational sites before the spray campaign, as well as actions taken.

**TABLE 1: PRE-SPRAY ENVIRONMENTAL COMPLIANCE ASSESSMENT FINDINGS/RECOMMENDATIONS AND ACTIONS TAKEN**

| Period | Findings and Recommendations | Actions Taken |
|---|---|---|
| PRE-SPRAY ASSESSMENT, CENTRAL WAREHOUSE AND OPERATIONAL SITE | Insecticide storage facility must be separated from other logistics, and from PPE and other materials storage. The central warehouse is a 1,000 square meter open space; it must be partitioned into three different sections to provide for insecticide storage, PPE and other equipment storage, and the larger section for the day-to-day management of spray teams. | Warehouse was sectioned off; a storage room for insecticides and solid waste was built, with double-locks limiting access of unauthorized personnel. A storage room was built for the PPE and other materials and equipment, including an area for spray pump repair. This room is also built with double-locks.<br>The larger section of the warehouse, which includes two large doors, one in the front and the other in the back, provides for delivery into the warehouse. The open space is organized with designated areas for spray brigades, with wall hangers and floor pallets where PPE and other supplies are stored to facilitate day-to-day deployment and return of brigades. |
| | Window cups are exposed, allowing water to enter the warehouse during wind-driven rainfall. | Aluminum covers were installed, covering all window caps; no further leakage has been detected. |

| Period | Findings and Recommendations | Actions Taken |
|---|---|---|
| | Roof presented leakage throughout; it must be repaired against further leakage. | Roof was repaired throughout; no further leakage detected. |
| | The concrete floor is broken in some sections throughout the warehouse; it must be sealed to make it impermeable. | Concrete floor was repaired; no further breaks observed during the spray campaign. |
| | Ventilation of the warehouse needs improvement, especially once new partitions are built for storage management. Install two windows in the back part of the warehouse. | Two additional external windows were installed in the back part of the warehouse; storage is for the PPE and other equipment. Thermostats were installed in the insecticide storage room to ensure the required room temperature is maintained. |
| | Soak pits are not fenced in; animals and unauthorized people have access to the open area. Fencing and gated locks must be installed before the spray campaign. | Soak pits/wash area perimeter was fully fenced; two gates with double locks installed to prevent access of unauthorized personnel and/or animals. |
| | Soak pits do not include pump hangers for airing/drying of spray pumps; nor are there lines to hang overalls to dry. These improvements must be completed before the spray campaign. | Two wrought iron pump hangers were built with the capacity to hang 100 spray pumps, and dry lines were erected throughout the open space around the warehouse to hang the overalls for air-drying. |
| | The wash area is too small to accommodate the 210 spray operators. Must expand area as to avoid overcrowding in the soak pits. | Wash areas of the two soak pits were made wider by nearly 2 meters; day-to-day rinsing process by the spray teams proved efficient, with no overcrowding observed. |
| **PRE-SPRAY ASSESSMENT, HUILA WAREHOUSE & OPERATONAL SITE** | The insecticide is stored in an open area with all other materials, equipment and PPE; not kept under double lock with danger signs well displayed on the gate. | A room within the warehouse was designated for insecticide storage, with double-locks and the appropriate warning signs on the door. |
| | Soak pits are fenced around, but without a gated lock. Gate must be installed before the spray campaign. | Gates with double locks were installed to prevent access of unauthorized personnel and/or animals. |
| | Soak pits do not include pump hangers for airing/drying of spray pumps; nor were there lines to hang overalls to dry. These must be completed before the spray campaign. | Two wrought iron pump hangers were built with the capacity to hang 80 spray pumps, and dry lines were erected throughout the open space around the warehouse to hang the overalls for air-drying. |

| Period | Findings and Recommendations | Actions Taken |
|---|---|---|
| PRE-SPRAY ASSESSMENT, CUNENE & OPERATIONAL SITE | The insecticide is stored in an open area with all other materials, equipment and PPE, not kept under double lock. Partition the warehouse with a room for the insecticide. | Warehouse was partitioned off with a storage room for the insecticide and solid waste storage, with a double lock. |
| | Soak pit is not fenced in; unauthorized people have access to the open area. Wash area is too small to accommodate the number of spray teams during the spray campaign. Fencing and gated locks must be installed before the spray campaign. | The wash area was elongated by nearly 2 meters; the day-to-day rinsing process by the spray teams proved efficient, with no overcrowding observed. Operational area was fenced in, with a gate with double lock installed. |
| | Soak pits do not include pump hangers for airing/drying of spray pumps; nor were there lines to hang overalls. These must be complete before the spray campaign. | One wrought iron pump hanger was built with the capacity to hang 80 spray pumps, and dry lines erected throughout the open space around the warehouse to hang the overalls for air-drying. |

## 2.5 HUMAN RESOURCE REQUIREMENTS

Abt's approach to self-reliant international program offices and capacity-building is manifest in the establishment of fully staffed and robust project offices with the required leadership and technical, management, administrative and financial skills. While the human resource capacity in Angola is very limited, the AIRS Angola central office is staffed with 15 staff members, including a Chief of Party (COP), Finance & Administrative Manager (F&A), Operations Manager, Environmental Compliance Officer, logistics coordinator, M&E Manager, Database Manager, information technology specialist, Huambo provincial coordinator, entomology coordinator, procurement coordinator, accountant, Administrative Assistant/Office Manager, driver, and a cleaning clerk.

For critical positions, including the Environmental Compliance Officer and Operations Manager, individuals of proven track record were hired without the skills and experience relevant to public health, IRS, or subject area expertise; however, Abt leveraged resources from other IRS countries to provide on-the-job training to these individuals. The program's entomology coordinator is very junior; however, he had previously received basic training and had two years of experience with the former PMI contractor. Through additional training and technical support from senior AIRS entomologists, he is continuing to develop and to grow in his area of expertise.

Additionally, the Huila Provincial office is staffed with a provincial coordinator, finance & administrative assistant, and a logistics assistant. Cunene is staffed with the provincial coordinator and a finance & administrative assistant. The Chief of Party and other technical staff based in the central office in Huambo provide ongoing management and technical support to the three provinces and maintain regular communications with the PDHs throughout the year. Seasonal hires were engaged to support the spray campaign. They included mobilization teams (mobilizers, team leaders and supervisors); data entry clerks, Warehouse Managers and assistants, who were also trained in handling spray pump repairs; and spray teams (spray operators, team leaders, supervisors, and senior supervisors).

## 2.6 TRAINING

Two Training of Trainers (ToTs) sessions were conducted to train for the particular skills needed during the mobilization (and enumeration) campaign and the spray operations campaign. The ToTs took place in Huambo approximately one week before the trainers were expected to train the mobilization and spray operations teams in their respective provinces.

Mobilization training for 414 mobilizer candidates lasted three days in each province. In addition to training on mobilization procedures, the participants spent about a day on data collection procedures, defining data elements and practicing scenarios to ensure the success of the sensitization process and accurate data collection. The spray operations training lasted five days, and in addition to practical training to use the equipment, a full day was spent training the operators to collect data and fill in the data collection forms. Team leaders and supervisors received additional training to ensure that they could verify the operator forms on a daily basis, before they were submitted to the provincial coordinator for final review and delivery to the data entry office.

Additional trainings for support teams complemented the main mobilization and spray operations trainings. Data entry clerk candidates were prescreened and brought to Huambo, trained, and sent back to their provinces. 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 or on the job on safe insecticide handling.

Junior entomology technicians, who included members from the Provincial Directorate of Health of Cunene, Huila and Huambo, were assembled in Huambo and trained in entomological monitoring to better support AIRS Angola entomology activities in their respective provinces.

**TABLE 2: PEOPLE TRAINED IN IRS**

| Categories of Persons Trained | Training on IRS Delivery | | | | | | | | | | Other Trainings | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Training of Trainers: Spray Ops | | Spray Operations | | Data Entry | | Logistics | | Technical Maintenance | | Training of Trainers: IEC Mobilization/ Enumeration | | IEC Mobilization/ 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 | M | F | M | F |
| Supervisors | 20 | 7 | | | | | | | | | | | | | | | | | | | | |
| Spray Operators | | | 400 | 209 | | | | | | | | | | | | | | | | | | |
| Data Clerks | | | | | 10 | 4 | | | | | | | | | | | | | | | | |
| Logisticians | | | | | | | 1 | 1 | | | | | | | | | | | | | | |
| Warehouse Assistants | | | | | | | | | 3 | 0 | | | | | | | | | | | | |
| Pumps/Technicians | | | | | | | | | 4 | 1 | | | | | | | | | | | | |
| Information, Education and Communication | 5 | 8 | | | | | | | | | 6 | 7 | 238 | 176 | | | | | | | | |
| Health Clinicians | | | | | | | | | | | | | | | 10 | 32 | | | | | | |
| Washers | | | | | | | | | | | | | | | | | 0 | 23 | | | | |
| Security Guards | | | | | | | | | | | | | | | | | | | 13 | 1 | | |
| Drivers | | | | | | | | | | | | | | | | | | | | | 24 | 0 |
| **TOTAL M/F** | **25** | **15** | **400** | **209** | **10** | **4** | **1** | **1** | **7** | **1** | **6** | **7** | **238** | **176** | **10** | **32** | **0** | **23** | **13** | **1** | **24** | **0** |
| **TOTAL/ training** | **40** | | **609** | | **14** | | **2** | | **8** | | **13** | | **414** | | **42** | | **23** | | **14** | | **24** | |
| **Grand TOTAL** | **1,203** | | | | | | | | | | | | | | | | | | | | | |

# 3. Advocacy, Communication, and Social Mobilization

## 3.1 Advocacy, Communications and Social Mobilization

AIRS Angola used various means of communication to promote awareness of the IRS program and impending campaign. From the time the project office was set up, the team organized and participated in as many advocacy meetings and events as possible. AIRS Angola worked with the National & Provincial Journalist Network against Malaria and Other Major Diseases, Radio Mais, and TAP Television Station to distribute promotional materials and reach out directly to communities.

The IEC and community-based mobilization was led by the AIRS Angola team with support from local health authorities. Selection of mobilizers, training, and door-to-door mobilization were the joint responsibility of the Provincial Health Authority and the AIRS Angola team, who provided oversight and support. AIRS Angola provided technical guidelines and logistics assistance for the IEC training, and provided all technical and logistics support and supervision during the mobilization process. In all provinces, the Permanent Malaria Officers collaborated with the AIRS Angola team and local administrative authorities to provide supervision.

AIRS Angola met with the NMCP communications coordinator and the Provincial Health Promotion Officers to agree on general procedures and micro-plans. As a result of the discussions, improvements were made, such as selecting IEC mobilizers from the communities and, after training, having them serve in their own communities. The AIRS Angola team was also responsible for engaging journalists through the National Journalist Network against Malaria and Others Major Diseases.

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; Umbundo (Huambo and Huila National dialects); Nhaneca (Huila National Dialect); and Kwanhama (Cunene National Language). A new IRS poster was designed and printed, and the IRS Structure Card was designed to be used to track the households' participation with IRS and to correspond to the M&E database. All communication materials were branded with the PMI logo and the Government of the Republic of Angola logo as appropriate. The official spray campaign was launched on October 29, 2012 in each of the three provinces. 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 2012 spray campaign. The day was also marked with the symbolic spraying of the house of a local authority.

## 3.2 Mobilization and Enumeration Data

AIRS Angola added structure enumeration to the mobilization campaigns. This activity consisted of identifying all eligible structures within targeted areas and disseminating IRS Cards to households, each card having a unique, serialized IRS structure number. AIRS Angola enumerated 196,321 structures, directly reaching 304,651 people over the age of 15, living in the target structures, with the IRS spray campaign message. This population was informed about program objectives, spray campaign procedures, and the precautions necessary to be safe. They were given project literature in their respective local dialect languages or in Portuguese. Occupants were also asked if they would accept

spraying; 98.4% of the sensitized population responded that they would accept for their home to be sprayed.

AIRS Angola encountered a few challenges during the enumeration campaign that contributed to a significant difference in the total number of structures found by mobilizers and structures found by spray operators. Namely, the mobilization/enumeration and spraying were scheduled to begin on September and October 1respectively. However, Angola's National elections held on August 31 became the only priority for government stakeholders at all levels from about June 1through September 15, 2012. This had an impact on AIRS Angola's planning activities, including the decision and production of IEC materials which pushed the onset of the campaign to October 8, 2012. Insecticide clearance was also delayed through the Ministry of Foreign Affairs, and duty-exemption took four weeks to be granted. With the delivery of insecticide completed on October 23, and the imminent start of rainy season, AIRS Angola in consultation with PMI Angola and the Government, made the decision to begin spraying on October 29while the mobilization/enumeration campaign was still on-going.

Consequently, for about two weeks, both enumeration and spray efforts were simultaneously occurring, the focus and efforts moved to spray operations, including staff that was tasked with enumeration data collection supervision, such as the operations team (i.e. field supervisors) and the M&E Manager, and thus, was not present to identify and address errors timely (i.e. mobilizing a structure more than once, mobilizing an ineligible structure, inflating the number of structures mobilized, etc.). In 2013, AIRS Angola will ensure better field supervision for both the mobilization and spray campaigns to guarantee enough on the ground overseeing data collection efforts. Measures will be applied to the 2013 mobilization campaign, whereby additional data entry clerks will be contracted, and an M&E Coordinator t will be contracted at each data center with the sole task of verifying data coming in from the field and data entered into the database. Additionally, every effort will be made to complete the mobilization campaign, with sufficient time to complete activities and enter all mobilization data before the start of spraying, to avoid these errors.

**TABLE 3: MOBILIZATION DATA:**
**NUMBER OF ELIGIBLE STRUCTURES FOUND IN TARGET AREAS**

| Province | Municipality | # of Structures Found by Mobiliser | # of Eligible Structures Sensitized | Number of Adults Reached with IRS Message | | | # of Structures Accepting IRS | % of Structures Accepting IRS | IEC Materials Distributed |
|---|---|---|---|---|---|---|---|---|---|
| | | | | Male | Female | Total | | | |
| Cunene | Kwanhama | 12,969 | 12,064 | 11,241 | 13,592 | 24,833 | 11,891 | 91.7% | 19,063 |
| | Namacunde | 3,960 | 3,918 | 2,920 | 3,364 | 6,284 | 3,837 | 96.9% | 5,090 |
| | Subtotal | 16,929 | 15,982 | 14,161 | 16,956 | 31,117 | 15,728 | 98.4% | 24,153 |
| Huambo | Huambo | 105,650 | 105,154 | 57,579 | 78,044 | 135,623 | 104,016 | 98.9% | 90,441 |
| Huila | Chibia | 3,590 | 3,504 | 3,200 | 3,658 | 6,858 | 3,346 | 93.2% | 3,497 |
| | Lubango | 71,990 | 71,681 | 55,938 | 75,115 | 131053 | 70,175 | 97.5% | 69,944 |
| | Subtotal | 75,580 | 75,185 | 59,138 | 78,773 | 137,911 | 73,521 | 97.8% | 73,441 |
| **Total** | | **198,159** | **196,321** | **130,878** | **173,773** | **304,651** | **193,265** | **98.4%** | **188,035** |

Globally, the AIRS project will report spray coverage in each country based on structures found by spray operators. (See Section 7.6: Spray Results.) This is done to maintain consistency across all AIRS

countries, since not all have or will carry out a separate enumeration exercise, and to be consistent with the reporting organization under the former contractor.

Table 4 presents the types and numbers of communication materials produced and distributed during this spray campaign.

**TABLE 4: COMMUNICATION MATERIALS**

| Item | No. Distributed |
|---|---|
| Posters | 400 |
| Banners | 12 |
| IRS Brochure | 155,000 |
| IRS Structure Card | 160,000 |
| T-Shirts | 1,500 |
| Cap | 1,000 |
| Polo Shirts | 300 |
| PMI Stickers | 650 |

Table 5 lists advocacy meetings and events, communications and promotional activities that were carried out. Pre-spray (mobilization and spray) messages were aired on the radio in three local dialects and in Portuguese. Mobilizers conducted sensitization and outreach door-to-door, and distributed printed materials. During the spray campaign, mobilizers first accompanied spray teams and then went ahead of them to alert households of the next neighborhoods to be reached by spray teams. The pre-alert was announced on the radio stations in both Portuguese and local dialects.

**TABLE 5: MOBILIZATION 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 | 100 |
| Radio spots (mobilization, before and during spray campaign) | 185 |
| Radio program (interactive show) | 50 |
| Television | 20 |
| Newspaper articles | 6 |
| Campaign launch | 3 |
| Evaluation meeting | 3 |

# 4. Spray Activities

## 4.1 Spray Operations and Supervision

Planning and preparation for all logistical aspects of the 2012 spray campaign began in March 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. Their day-to-day responsibilities included managing: commodities and equipment (PPE, spray pumps, insecticide, etc.), spray pump repairs, and solid waste generated from IRS; as well as cleaning warehouses and ensuring that these were maintained according to environmental compliance standards. To guarantee that there was no pilferage or loss, the Warehouse Managers and assistants carefully managed daily tracking of the insecticide, with support from the provincial logistics assistants and the logistics coordinator. Security guards oversaw the security at the warehouses 24 hours per day, seven days per week, with two guards at each station.

Abt consolidated the number of trucks used in spray operations and logistics and was able to negotiate a lower cost per vehicle compared to previous years. Minibuses and trucks were contracted to transport spray operations teams and for field supervision.

The 2012 IRS campaign was officially launched on October 29 in all three provinces, and officially ended on December 18, 2012. In Cunene, spraying began on the same day as the official launch, on October 29, and was finished on November 24. Huila began spraying on October 30 and finished on December 15; and teams in Huambo began spraying on October 31 and finished on December 18.

The structure of spray teams was as follows: six spray operators formed a team, each team was assigned a team leader, three teams formed a brigade, and each brigade was assigned a supervisor. Above the brigade level, there were field supervisors. Field supervisors, together with brigade supervisors and spray team leaders, planned and coordinated all daily activities, including micro-planning for the spray teams, daily spray target strategy, tactics for deployment, and resolving any issues or challenges that arose. Daily meetings with the Abt provincial coordinator ensured smooth IRS operations at each site.

In addition to guiding the teams, brigade supervisors were responsible for receiving the daily insecticide requirement from the Warehouse Manager, and for distributing insecticide to each spray operator and ensuring that empty and full sachets were returned at the end of each spray day to prevent loss or pilferage.

A joint team of Abt provincial coordinators and the senior management/technical team, provincial/municipal malaria supervisors, and Provincial Malaria Program Officers conducted regular field visits to ensure that the spray operations were advancing as planned, and to ensure compliance with environmental and personal safety measures. These supervision visits also served as a chance to increase community leaders' participation and enthusiasm and to work with community leaders to solve any problems that arose.

Each spray operator targeted a minimum of 10 structures per day, and the IRS program sought to achieve this level of spraying each day across all spray operators on a six-day work week schedule, Monday through Saturday. Developed by the AIRS-wide Operations Director, the site performance daily tracking sheet tracked daily performance of the spray teams, and insecticide use. It also graphed the expected daily and cumulative number of structures to be sprayed per day, by province and nationally

against the real-time progress in the field. This tool allowed real-time data monitoring, and it allowed the IRS program to gauge progress and tweak operations accordingly. Spray performance updates were submitted to PMI, the NMCP and the PDHs on a weekly basis in both English and Portuguese throughout the spray campaign.

The COP was ultimately responsible for ensuring that IRS activities proceeded according to plan. She was always in contact with the teams in the field, by phone and/or in person in all three provinces, connecting with provincial coordinators, the Operations Manager, the PDHs Provincial Malaria Program Officers and the provincial malaria supervisors), IEC supervisors, and team leaders. In many cases, she would also liaise with the spray operators, IEC mobilizers, and warehouse teams to boost their morale. The COP also participated in the weekly PDH Huambo meeting and updated the Provincial Director and others on the progress of the campaign.

# 5. POST-SPRAY ACTIVITIES

## 5.1 EVALUATION MEETINGS

The 2012 IRS spray campaign officially ended on December 18. Post-spray evaluation meetings were held in Cunene, Huila, and Huambo on February 7, 8, and 20 respectively. Led by the respective Directors of the Provincial Directorates of Health in each province, participants included representatives from the NMCP, malaria focal points, members of the mobilization teams, (two supervisors, team leaders and mobilizers), and members of the spray operations teams (two field supervisors, brigade supervisors, team leaders, spray operators, and warehouse assistants). Other participants included beneficiaries, community leaders and municipal departments of health. The focus of the evaluation meetings was to report results, document challenges and opportunities encountered during the spray campaign, discuss lessons learned, and make recommendations for the next spray campaign.

The meeting agenda included a general session with presentations by the government highlighting the provincial malaria prevalence, the importance of IRS as a malaria intervention, and the partnership between Abt and the government, including overall results of the 2012 spray campaign. It was followed by presentations by AIRS Angola, including the Chief of Party, Operations Manager, Environmental Compliance Officer, and provincial coordinator, who presented detailed spray campaign results. This set the stage for the two-hour interactive session with participants, moderated by the Provincial Malaria Program Officer and/or malaria supervisor and the COP and/or Environmental Compliance Officer. This session allowed participants to openly express their input and discuss with the broader audience how we may proceed in the future. Some of the topics of discussion included:

- Mobilization and spray personnel recruitment; age criteria.
- Community leaders' role in mobilization of the communities.
- Reference materials for trainers.
- Increased training duration.
- A longer day in the field for mobilization and spray, as the Angola climate is favorable.
- Six-day work week; the first time implemented in Angola.
- Preventing pilferage of IRS materials and supplies.
- Increased awareness and adherence to environmental compliance.
- Morning breakfast and afternoon milk for spray teams; the first time implemented in Angola.
- Capacity-building and sustainability of the IRS program in the next 5 years for Angola.

## 5.2 POST-SPRAY COMMUNICATION ACTIVITIES

Post-spray radio messages were aired to remind the communities of the need to avoid behaviors that will negate the spray campaign such as repainting, re-plastering, and covering the sprayed walls with objects. In addition, AIRS Angola will continue behavior change communication activities until the next spray cycle to ensure that the communities and stakeholders fully accept the IRS concept and that the required actions are taken to extend the residual life of insecticide on the walls. The post-spray activities

may include dissemination of IRS information in partnership with faith-based organizations, community chiefs, schools, and the municipal authorities. The aim is to maintain IRS awareness in the communities until the next spray cycle, thus enhancing the activities of the next spray operations.

## 5.3 Demobilization Logistics and Waste Disposal

After the spray campaign, the AIRS Angola team carried out progressive rinsing of barrels, washing buckets, overalls, boots, and gloves worn during the 2012 campaign. Spray pumps were cleaned, repaired as needed, and conditioned for off-season storage. All program materials were collected, inventoried and stored during the demobilization exercise. Table A-1 in Annex A reflects all IRS Angola inventory currently in stock in the three warehouses and available for the next spray campaign, which will be used as the basis for the development of the 2013 procurement plan.

A post-spray environmental compliance assessment was completed and documented. The wash bays/soak pits are locked, the warning signs remain posted, and surrounding areas are maintained clean of weeds and other trash. The areas are monitored by the security guards on a 24/7 schedule with two guards on a 24-hour rotating schedule.

Solid waste generated by the campaign was maintained separately from PPE and other supplies and equipment. It was separated, repackaged in each of the provincial warehouses, and further consolidated at the central warehouse. A total of 1,700 kilos of AIRS Angola solid waste was trucked to Viana, Luanda, where it was incinerated at Recolix Environmental Engineering. Recolix is the only the facility licensed and accredited by the Ministry of Environment to handle disposal of solid/toxic waste, and it has handled the incineration of IRS solid waste since the inception of the program in Angola. Solid waste management was completed on January 28, 2012 and the Certificate of Incineration was received the same day.

# 6. ENTOMOLOGY

## 6.1 INSECTICIDE RESISTANCE

Entomological monitoring is an important component of the IRS project. An insecticide resistance study was conducted in Lobito (Angola) between 2003 and 2005 by research institutes in collaboration with the NMCP before the PMI-supported IRS program began. The study results clearly indicated that the main vector, *An. gambiae* s.l., was fully susceptible to all four different insecticides tested from the pyrethroid class. The results also showed emerging resistance to DDT. The incumbent had conducted similar studies in 2010 and 2011. The difference was that in 2010 *An. coustani* mosquitoes, instead of *An. gambiae* s.l., were tested using standard WHO resistance assays against deltamethrin and bendiocarb. The mosquito mortality rate after one-hour exposure to the insecticide and a 24-hour holding period was 100% for deltamethrin and 95% for bendiocarb respectively. In 2011, using mosquitoes collected from the intervention areas, the mortality rate of *An. co*ustani ranged from 94% to 100% for deltamethrin, and was 97% for bendiocarb. Fifteen female *An. gambiae* s.l. were tested for deltamethrin from Cunene province, and 30 for bendiocarb from Huila, with mortality rates of 93.3% and 90% respectively.

Insecticide-resistance data collected in 2012 by Abt Associates revealed full susceptibility of *An. coustani* to diagnostic concentrations of deltamethrin, bendiocarb and fenitrothion, with test mortality rates of 100% for all the three insecticides. The 2012 test mortality rates of *An. coustani* were slightly higher than those from 2011. The test mortality rates of *An. gambiae* s.l., on the other hand, ranged from 94% to 97.5% for deltamethrin.

The AIRS Angola team conducted insecticide resistance tests using standard WHO bioassay kits using 1- to 5-day-old non-blood fed mosquitoes to inform the insecticide selection for the 2012 spray season. Two to five day-old emergent *An. gambiae* s.l. were exposed to 0.05% deltamethrin, and *An. coustani* were exposed to 0.05% deltamethrin (pyrethroids: PY), 1% fenitrothion (organophosphate: OP), and 0.1% bendiocarb (carbamate), using the WHO kit to determine their level of susceptibility to insecticides. Due to the low emergence rates, the tests for all *An. coustani* and *An.gambiae* s.l. from the provinces of Huambo and Huila consisted of both males and females recently emerged from field-collected larvae and pupae. The controls were exposed to clean paper impregnated with oil. The emergent mosquitoes were pooled together by province in the process of testing and the results were reported by province. The knockdown rates were recorded every 15 minutes until one hour post-exposure. The mortality rate observed in the test tubes and control tubes was observed 24 hours post-exposure and corrected appropriately using Abbott's formula. Results are presented below.

**TABLE 6: SUSCEPTIBILITY TESTING RESULTS FOR *AN. COUSTANI* AND *AN. GAMBIAE* IN HUAMBO, CUNENE AND HUILA PROVINCES – MAY 2012**

| Province | Test | Species | # Mosquitoes | Knockdown | | | | Dead 24 Hrs. | % Mortality |
|---|---|---|---|---|---|---|---|---|---|
| | | | | 15 Min. | 30 Min. | 45 Min. | 60 Min. | | |
| Huambo | Deltamethrin | *An. coustani* | 80 (4) | 33 | 67 | 77 | 77 | 80 | 100 |
| | Fenitrothion | *An. coustani* | 60 (3) | 0 | 0 | 1 | 8 | 60 | 100 |
| | Bendiocarb | *An. coustani* | 20 (1) | 2 | 6 | 19 | 20 | 20 | 100 |
| | Deltamethrin | *An. gambiae* s.l. | 16 (1) | 5 | 10 | 13 | 15 | 15 | 93.75 |
| Huila | Deltamethrin | *An. gambiae* s.l. | 35 (2) | 23 | 31 | 32 | 32 | 33 | 94.29 |
| | Bendiocarb | *An. coustani* | 40(2) | 5 | 13 | 33 | 37 | 40 | 100 |
| Cunene | Deltamethrin | *An. gambiae* s.l. | 80(4) | 32 | 63 | 69 | 75 | 78 | 97.5 |

**TABLE 7: PERCENTAGES KNOCKDOWN FOR EVERY 15 MINUTES DURING THE SUSCEPTIBILITY TESTING FOR HUAMBO, CUNENE AND HUILA PROVINCES – MAY 2012**

| Province | Test | Species | # Mosquitoes | Knockdown | | | | % Mortality 24 hrs. | Abbotts |
|---|---|---|---|---|---|---|---|---|---|
| | | | | 15 Min. | 30 Min. | 45 Min. | 60 Min. | | |
| Huambo | Deltamethrin | *An. coustani* | 80 (4) | 41.25 | 83.75 | 96.25 | 96.25 | 100 | |
| | Fenitrothion | *An. coustani* | 60 (3) | 0 | 0 | 1.67 | 13.33 | 100 | |
| | Bendiocarb | *An. coustani* | 20 (1) | 10 | 30 | 95 | 100 | 100 | |
| | Deltamethrin | *An. gambiae* s.l. | 16 (1) | 31.25 | 62.5 | 81.25 | 93.75 | 93.75 | 93.62 |
| Huila | Deltamethrin | *An. gambiae* s.l. | 35 (2) | 65.71 | 88.57 | 91.43 | 91.43 | 94.29 | 93.55 |
| | Bendiocarb | *An. coustani* | 40 (2) | 12.5 | 32.5 | 82.5 | 92.5 | 100 | |
| Cunene | Deltamethrin | *An. gambiae* s.l. | 80(4) | 40 | 78.75 | 86.25 | 93.75 | 97.5 | |

## 6.2 MONITORING VECTOR DENSITY, DISTRIBUTION, SEASONALITY AND BEHAVIOR

The first entomological data collection on vector density, distribution, and seasonality and behavior was completed in October 2012, before the start of the spray campaign. Subsequent post-spray entomological monitoring activities will continue monthly for about six months. Collections are undertaken in an area that has received IRS and in a non-intervention area.

Centers for Disease Control (CDC) light traps were used to sample mosquitoes. Traps were suspended indoors 5-6 feet from the ground, next to human bait sleeping under untreated nets. Because Insecticide-Treated Net (ITN) coverage was low, the project procured and provided untreated nets to cover people residing in the sampled houses. Eighteen and 24 houses were randomly sampled from the control and intervention areas for the mosquito collection, respectively.

Pyrethrum spray catches were not conducted because several attempts at collecting indoor resting mosquitoes using this method were found to be unproductive compared to the CDC light traps. The project will procure and supply aerosols with piperonyl butoxide for future tests, and evaluate whether the results remain consistent.

## 6.3 QUALITY & DECAY MONITORING

The ideal approach for cone wall bioassays is to expose known laboratory-reared, 2- to 5-day-old mosquitoes from susceptible colonies onto sprayed walls, and record mortality rates after a 24-hour recovery period (for the mosquitoes), to assess the quality of spraying. Since AIRS Angola did not have access to a susceptible mosquito colony, the team collected larvae and pupae from the field, and reared them to adults in the office insectary to conduct the cone bioassay testing.

Larvae collection was carried out in three main breeding sites in the Huambo Province, including the Caala, Chivela and Benfica neighborhoods. These are similar areas to where larvae and pupae collection was conducted during the May 2012 insecticide susceptibility study. The test mortality rate of *An. gambiae* s.l. for deltamethrin was 93.75% in May 2012. According to the WHO classification criteria, the result falls under possible resistance that needs to be confirmed. For the current cone bioassay, mosquitoes from the same source were used, assuming the susceptibility of the vector had remained unchanged since May 2012.

The standard WHO cone assay was used to evaluate the quality of spraying and potency of the insecticide at selected resting surface heights of 0.5 meters, 1.0 meters, 1.5 meters, and 2.0 meters.

The number of *An. gambiae* s.l. used for the cone bioassay tests at times T0, T1 and T2, and the number of mosquitoes dead after a 30-minute exposure to delamethrin sprayed walls and a 24-hour holding period, are described in Table 8 and Figure 1 below. The test mortality rates were 97.86%, 97% and 80% at time T0, T1 and T2, respectively (Table-8 and Fig- 2). The 2-3% survivorship of the exposed mosquitoes at T0 and T1 could possibly be explained by the susceptibility level of the local vectors to deltamethrin. The 20% survival of the tested mosquitoes at T3 might be due to a combination of factors that include insecticide decay 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 would be anticipated if a susceptible mosquito colony were to be used.

**TABLE 8: CONE BIOASSAY TEST RESULTS OF *AN. GAMBIAE* S.L. FROM NOVEMBER 2012 (T0) TO JANUARY 2013 (T2)**

| Province | Period of test | No Houses tested | No Mosquitoes tested | No mosquitoes dead | % observed mortality | % corrected mortality |
|---|---|---|---|---|---|---|
| Huambo | T0 (within two weeks of spraying) | 5 | 140 | 137 | 97.80% | No difference between the observed and corrected mortality |
| | T1 (one month after spraying) | 17 | 460 | 446 | 97.0% | |
| | T2 (two months after spraying) | 12 | 297 | 238 | 80% | |

**FIGURE 1: CONE BIOASSAY TEST RESULTS OF *AN. GAMBIAE* S.L., BY NUMBER OF MOSQUITOES EXPOSED AND NUMBER DEAD AFTER 30 MINUTE EXPOSURE AND 24- HR HOLDING PERIOD AT T0, T1 AND T2**

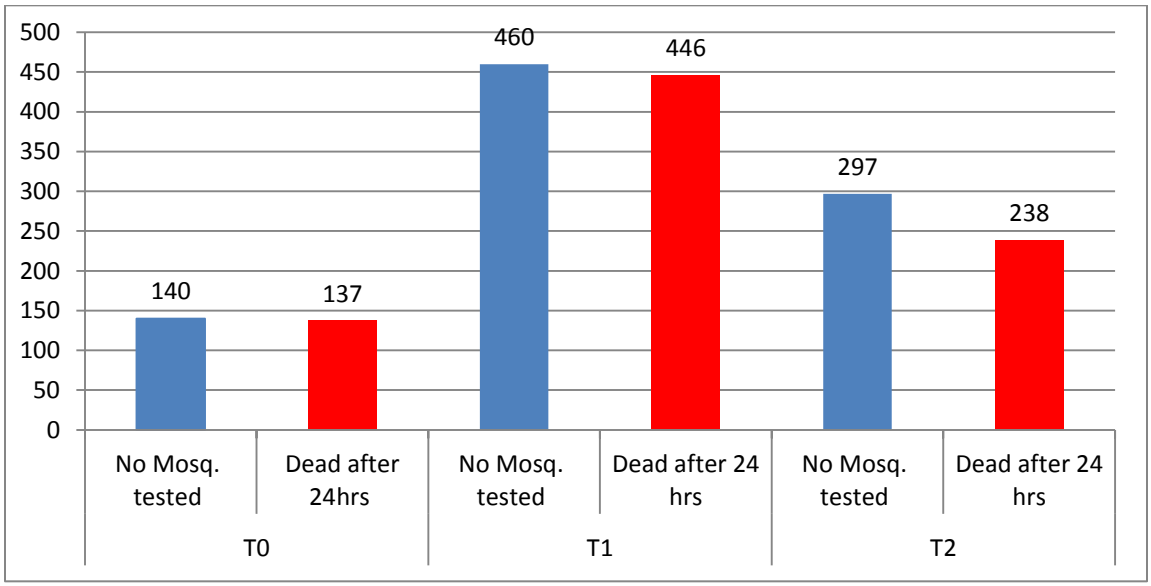
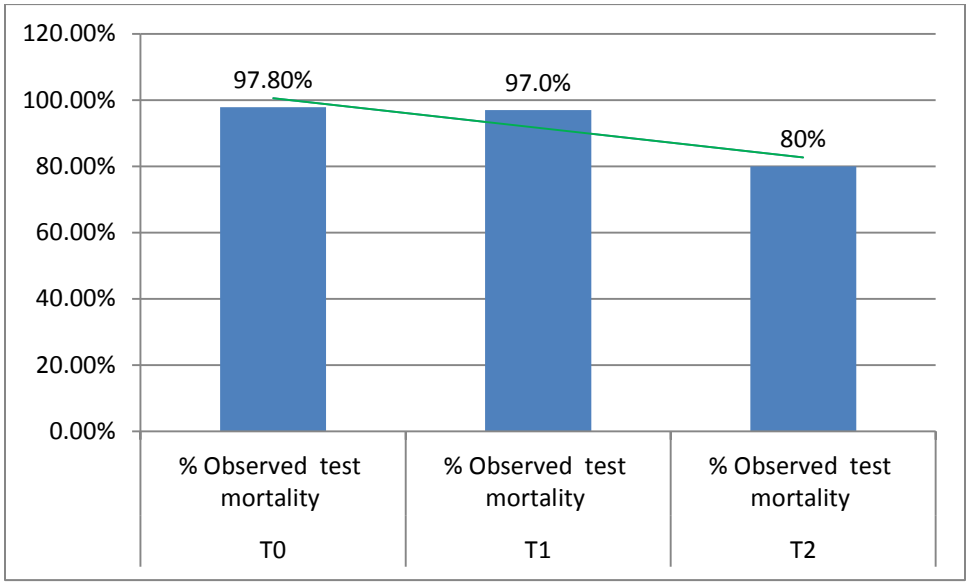


**FIGURE 2: SUMMARY OF THE PERCENTAGE TEST MORTALITY RATES OF *AN. GAMBIAE* S.L. EXPOSED TO SPRAYED WALLS AT TIME T0 (WITHIN TWO WEEKS OF SPRAYING), T1 (ONE MONTH AFTER SPRAYING) AND T2 (TWO MONTHS AFTER SPRAYING)**



# 7. MONITORING & EVALUATION

## 7.1 KEY OBJECTIVES AND APPROACH

The 2012 spray campaign was the eighth sponsored by PMI in Angola, but the project applied lessons learned from AIRS programs in other countries and from IRS campaigns conducted by other partners in Angola in order to:

- Track progress towards contractual obligations and organize corresponding documentation.
- Ensure the accuracy of both the data collection and the data entry process through comprehensive trainings and supervision at all levels.
- Streamline and standardize the 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.

## 7.2 DATA COLLECTION AND MANAGEMENT

Data collection closely followed the process described in the annual work plan. Data collection was done in two overlapping phases. In order to give confidence to the spray operator's results, an initial mobilization and enumeration campaign started about three weeks before the spray campaign launch. Each eligible structure in the targeted area was enumerated (i.e., counted, and given a unique IRS Card number that the spray operators could use during the spray campaign). The second phase of data collection was conducted during the spray campaign. Spray operators sprayed structures and identified them by their unique IRS number. In cases where households had misplaced the IRS Card, spray operators issued them a new IRS Card with a new unique structure number. All sprayed structures were assigned an IRS number for data entry purposes.

Data were collected using standardized data collection forms designed to capture all core PMI indicators (Table 9.) All data collection was preceded by training on data capture. Mobilization/enumeration data were collected by IEC implementers (or mobilizers) during house-to-house sensitization, and spray data were collected by spray operators during spray operations. Please refer to the table below for a description of AIRS Angola's 2012 data collection tools.

**TABLE 9: ANGOLA AIRS 2012 DATA COLLECTION TOOLS**

| Data collection tool | Person Responsible |
|---|---|
| **Training and Activity Registration Sheet** | Used by lead trainers to uniformly collect data about the individuals trained, including gender and IRS role. |
| **Daily Spray Operator Form** | Used by Spray Operators during the spray campaign to record structures and rooms found and sprayed, population protected, and mosquito net availability and use. |
| **Daily Team Leader Form** | Used by team leaders of spray operators during spray operations to verify and summarize the data collected by and the activity of the Spray Operators. |
| **IEC Mobilization/Enumeration Form** | Used by IEC mobilizers during pre-spray mobilization/ enumeration activities to sensitize and count eligible structures, and capture data on the population reached with IRS messages. |
| **Mobilizer Team Leader Form** | Used by team leaders of mobilizers daily during mobilization/ enumeration to verify and summarize the data collected by and the activity of the mobilizers. |

Data collected by both mobilizers and spray operators were verified and approved by team leaders and field supervisors each day before the paper forms (or data collection tools) were transported to the data centers for entry into the database. Additionally, other IRS staff (e.g., provincial coordinators, M&E Manager, Database Manager, Operations Manager) conducted field visits to supervise data collection during both mobilization/enumeration and spray activities. During the field visits, these staff reviewed and verified data collected and recorded by mobilizers and spray operators.

## 7.3 DATA CLEANING AND VERIFICATION

The M&E Manager trained and supervised a small team that included the Database Manager and data entry clerks, to clean and verify all data entered into the database. Any remaining discrepancies, after initial data cleaning efforts were completed, were reviewed in more detail and rectified by the M&E Manager.

Data cleaning procedures involved the following:

- Ensure that all data collection tools/forms were entered correctly;
- Make necessary corrections to ensure that the totals and details data entry were in agreement;
- Check and remove duplicate records; and
- Identify and enter missing records.

Please see Table 10 for a full list and description of the data quality and control tools and methods that were used for data quality and integrity purposes.

**TABLE 10: DATA QUALITY ASSURANCE AND CONTROL (QA/QC)**

| QA/QC Issue | Method/Tools for Quality Assurance |
|---|---|
| Data Integrity: Mobilization and Spray | • Standardized data collection forms<br>• Comprehensive training for data collectors<br>• Multiple levels of supervision<br>  ◦ In the field: Team leaders and supervisors oversee campaign activities and data collection<br>  ◦ Provincial coordinators supervise Team leaders and supervisors<br>  ◦ M&E Manager and Database Manager monitor standards of data collections and application of training<br>  ◦ In the data center: M&E Manager and Database Manager conduct spot checks of data entry<br>  ◦ M&E Manager and Database Manager monitor the database<br>• Database designed with logic tests |
| Data Entry and Management | • Comprehensive training for data clerks<br>• Totals data entered within 24 hours<br>  ◦ Follow-up data entry of details data<br>• Statistical analyses of data for irregularities<br>• Database spot checks |
| Data Security and Storage | • Data collection forms are stored by date and further organized by team number in three ring binders.<br>• Forms were locked in the data entry office while in use.<br>• The computers and databases are password-protected.<br>• Forms are archived in locked cabinets after data collection and cleaning are complete. |

## 7.4 DATA ENTRY

AIRS Angola contracted 10 data entry clerks to verify and enter enumeration and spray data collected from the three targeted provinces. The project used eight desktop computers that were transferred from the former PMI contractor, and procured two additional machines. All computers were installed with the most recent version of the AIRS Microsoft Access project database. Data were entered simultaneously at each of the three provincial data centers. Data entry was performed at two levels: (1) first by "Totals" for quick reporting and feedback, and (2) then by "Details" for quality control purposes. The data included in this report were generated from spray *Details* data. Details data entry provides the most accurate picture of the AIRS Angola spray campaign activities, because the database incorporates several verification checks during data entry.

## 7.5 DATA STORAGE

Mobilization/enumeration and spray forms are stored in three-ring binders at each data center. All mobilizer and spray operator forms are filed by mobilization or spray date and then by team number code within the binders.

## 7.6 RESULTS

The following tables provide a summary of the 2012 spray operations data, highlighting all core PMI indicators.

**TABLE 11: SUMMARY OF SPRAY RESULTS: ANGOLA 2012 IRS CAMPAIGN**

| Province | Municipality | Structures Found | Structures Sprayed | % of Structures Sprayed | Population Protected | Population Not Protected | % of Population Protected | Pregnant Women in Sprayed Structures | Children <5 Years in Sprayed Structures | Insecticide-Treated Nets | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | | | Total ITNs Found | Pregnant Women Sleeping under ITNs | Children <5 Years Sleeping under ITNs |
| Cunene | Kwan Yama | 11,586 | 11,126 | 96.0% | 51,712 | 2,048 | 96.2% | 2,479 | 8,770 | 10,975 | 1,901 | 5,703 |
| | Namacunde | 3,488 | 3,281 | 94.1% | 15,155 | 623 | 96.1% | 878 | 2,878 | 2,852 | 576 | 1,746 |
| | Subtotal | **15,074** | **14,407** | **95.6%** | **66,867** | **2,671** | **96.2%** | **3,357** | **11,648** | **13,827** | **2,477** | **7,449** |
| Huambo | **Subtotal** | **65,176** | **63,263** | **97.1%** | **292,822** | **3,742** | **98.7%** | **16,486** | **53,373** | **48,592** | **12,961** | **32,066** |
| Huila | Chibia | 1,649 | 1,644 | 99.7% | 8,212 | 17 | 99.8% | 503 | 1,523 | 1,112 | 350 | 710 |
| | Lubango | 63,208 | 62,468 | 98.8% | 304,387 | 4,719 | 98.5% | 16,703 | 49,134 | 38,811 | 11,094 | 22,723 |
| | **Subtotal** | **64,857** | **64,112** | **98.9%** | **316,401** | **4,736** | **98.5%** | **17,206** | **50,657** | **39,923** | **11,444** | **23,433** |
| **Total** | | **145,107** | **141,782** | **97.7%** | **676,090** | **11,149** | **98.4%** | **37,049** | **115,678** | **102,342** | **26,882** | **62,948** |

**FIGURE 3: SPRAY PROGRESS THROUGHOUT THE DURATION OF THE CAMPAIGN**

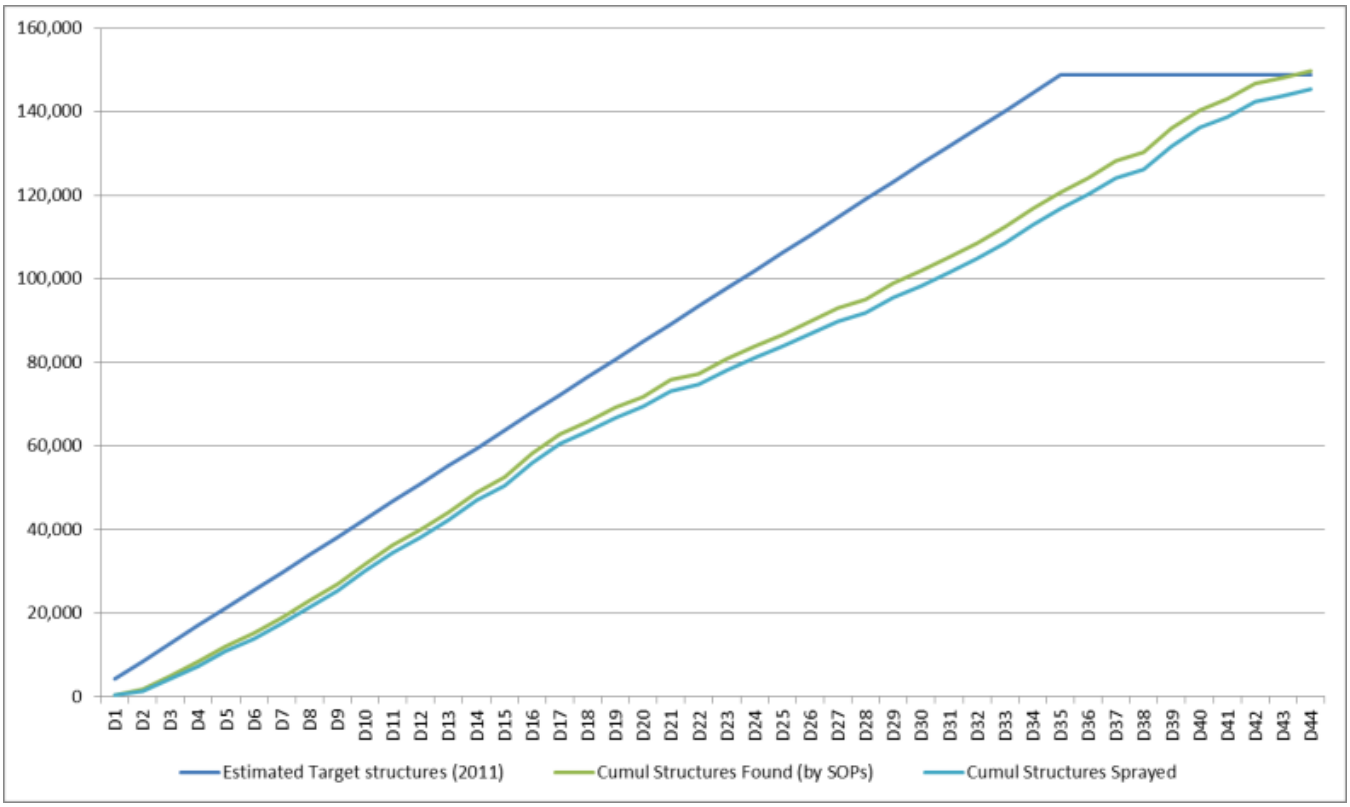



**TABLE 12: POPULATION PROTECTED, DISAGGREGATED BY GENDER AND VULNERABLE GROUP**

| Area | Sprayed Total Pop | Male Population Protected | Female Population Protected | Number of Pregnant Women Protected | Number of Children < 5 protected |
|---|---|---|---|---|---|
| Cunene | 66,867 | 34,471 | 32,396 | 3,357 | 11,648 |
| Huambo | 292,822 | 151,644 | 141,178 | 16,486 | 53,373 |
| Huila | 316,401 | 163,287 | 153,114 | 17,209 | 50,670 |
| Grand Total | 676,090 | 349,402 | 326,688 | 37,052 | 115,678 |

**FIGURE 4: SPRAY PROGRESS,[2] BY PROVINCE**

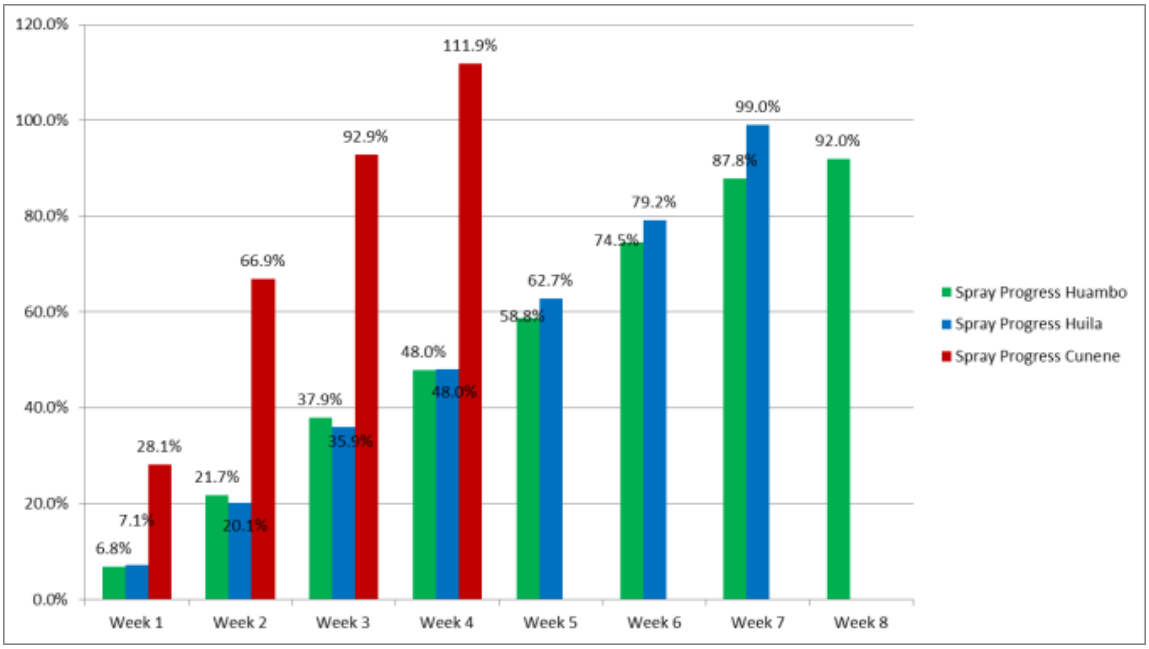
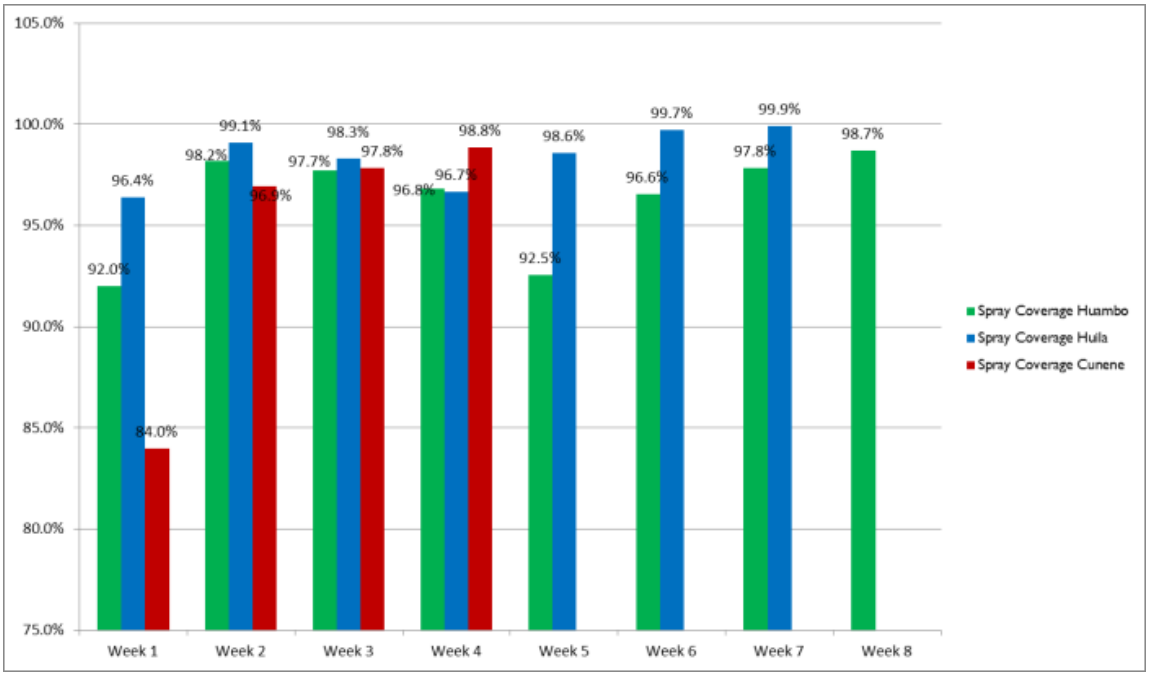



**FIGURE 5: SPRAY COVERAGE,[3] BY PROVINCE**




[2] *Spray progress* is calculated by dividing the number of structures found by spray operators in 2011 by the number of structures sprayed in 2012. A spray progress greater than 100% indicates that spray operators found and sprayed more structures in 2012 than they found, in total, during the last spray campaign (2011).

[3] *Spray coverage* is calculated by dividing the number of structures found by spray operators (2012) by the number of structures sprayed (2012).

## 7.7 MOSQUITO NET COVERAGE

Mosquito net coverage in the areas sprayed was included in routine data collection (Table 13). Residents were asked how many mosquito nets were available in the household and how many pregnant women and children less than 5 years slept under a mosquito net the night before.

**TABLE 13: MOSQUITO NETS USE, DISAGGREGATED BY VULNERABLE GROUP**

| Province | Insecticide-Treated Nets | | |
|---|---|---|---|
| | Total ITNs Found | Pregnant Women Sleeping under ITNs | Children <5 Years Sleeping under ITNs |
| Cunene | 13,827 | 2,477 | 7,449 |
| Huambo | 48,592 | 12,961 | 32,066 |
| Huila | 39,923 | 11,444 | 23,433 |
| **Total** | **102,342** | **26,882** | **62,948** |

## 7.8 INSECTICIDE USE AND SPRAY PERFORMANCE

Data on insecticide stocks and use, and spray operator performance are presented in Tables 14 and 15.

**TABLE 14: INSECTICIDE SACHET STOCK**

| Item | Unit of measure | Received | Sample for QA | ToT | Used | Wastage/ Loss | Stock Balance |
|---|---|---|---|---|---|---|---|
| Insecticide | Sachets | 111,325 | 0 | 0 | 78,207 | 2 | 35,325 |

Notes: Total Insecticide received reflects 11,325 transferred from RTI, 100,050 procured in 2012; Stock Balance reflects total balance based on physical count of every insecticide sachet remaining at the (central and Huila warehouses). ToT=training of trainers/IRS

**TABLE 15: SPRAY PERFORMANCE AND INSECTICIDE USE**

| Province | Spray operators worked | Structures sprayed | Sachets used | Structures sprayed/ sachet | Structures sprayed/SOP/ day |
|---|---|---|---|---|---|
| Cunene | 1,876 | 14,407 | 6,386 | 2.3 | 7.7 |
| Huambo | 6,148 | 63,263 | 33,373 | 1.9 | 10.3 |
| Huila | 5,826 | 64,112 | 38,448 | 1.7 | 11.0 |
| **Total/Average** | **13,850** | **141,782** | **78,207** | **1.8** | **10.2** |

# 8. FINANCE AND PAYMENT STRATEGIES

The F&A department is led by a Finance and Administrative Manager and an accountant, both based at the central project office in Huambo. Given the historical financial management issues with the former contractor, which were highlighted and discussed at length with PMI Angola during Abt's November 2011 start-up visit, Abt staffed the F&A Manager position with a seasoned Financial Manager. Huila and Cunene both had a finance and administrative assistant who handled financial matters at the provincial level, reporting to the F&A Manager in Huambo through their respective provincial coordinators. The F&A department worked closely with the COP and the technical and operational teams, both in preparation for and throughout the mobilization and spray campaigns, handling all campaign financial-related matters, including contracting and payment of seasonal personnel. Abt established its corporate bank account with the Banco Angolano de Investimentos (BAI) in March 2012, largely because of BAI's experience working with the former contractor for the disbursement of seasonal personnel payments in 2011. The criteria for the recruitment of seasonal personnel required all candidates to have a valid bank account, preferably with BAI, to facilitate payments during the campaign. Payments would only be made via bank transfer; cash payments were not an option.

During the process of contracting seasonal personnel, the team discovered that over 50% of the seasonal personnel did not have a bank account, although their applications indicated otherwise. Working closely with BAI, Abt helped them open bank accounts. This, however, was very time-consuming, and strained the F&A department. Payment of seasonal personnel was done biweekly, processed through the F&A database upon approved contracts and attendance sheets. While the first payment was completed smoothly, subsequent payments were delayed and subject to gross errors by the bank. At the end of the spray campaign, numerous workers complained that they did not receive the correct amount of payment from the bank, causing a backlog for the F&A department. Because BAI was unable and unwilling to provide Abt with detailed bank statements, verifying outstanding amounts due was a very lengthy process. Abt is shopping for an alternative bank option and evaluating the promise made by BAI to improve upon past performance. For 2013, the payment schedule will be established once a month to allow a more manageable process and outcome. Abt will also employ a finance assistant to support the F&A department.

# 9. Challenges and Lessons Learned

## 9.1 Challenges

- Reaching the starting line earlier: From developing the work plan to micro-planning meetings, it was important to ensure that the spray campaign began on or about October 1 in order for it to be completed before the onset of the rainy season and the Christmas holidays. Unfortunately, Angola's national election, including the political campaign during the months leading up to August 31, and the unavailability of national and provincial government counterparts during this time, delayed the IRS spray campaign, which began about a month late (October 29). Delivery of insecticide and printing of IEC materials was also delayed by 45 days from the original plans.
- Geographic distance between the three provinces and Luanda: The distances between the three IRS provinces and between these and Luanda, poor road conditions, infrequent flights, and the lack of project vehicles made regular visits for management and technical oversight difficult. This also limited participation by PMI, the NMCP and provincial governments.
- Strengthening advocacy and community mobilization: Community leaders, including the Sobas, were expected to have a greater presence during mobilization and spray campaigns; a more active role will be sought to ensure greater awareness and acceptance of IRS in 2013.
- Refusal: Some homeowners were not very cooperative, claiming lack of time, or inconvenience of moving personal belongings outside for the required period of time, even when mobilizers and spray operators were willing to assist. Technically, spray operators cannot touch anything in the house, given that their PPE is already in contact with insecticides. Through greater advocacy of the benefits of IRS, ownership by the community leaders, and forewarning, homeowners may find the time to move personal belongings.
- Training period: Not enough time was allowed for the Mobilization ToT and the two-day mobilizer training. This led to the need for refresher trainings to improve the quality of worker performance.
- Falsification of IRS data: Both during the mobilization and spray campaigns, workers attempted to falsify data, especially increasing numbers of structures sprayed, attempting to cover for absent colleagues, etc. This behavior was not tolerated, and implicated workers were immediately dismissed.
- Entomological monitoring in the three target provinces: The lack of trained specialists and entomological capability, and the distance between target areas, have made consistent entomological monitoring of all municipalities impossible.
- Desired criteria for data clerks not met: Not all data entry clerk applicants met the desired criteria, so it was necessary to provide more training and closer supervision than had been anticipated. This attention did, however, significantly improve technical skills and professional capacity of the selected candidates.
- Resistance to change: Seasonal workers were accustomed to the previous organization conducting IRS, and were at first resistant to incorporating the changes that had been made to mobilization and spray procedures. During training and in the first few days of the campaign, constant supervision

and review were necessary to ensure that improved standards for data collection and spraying were upheld.

## 9.2 LESSONS LEARNED

- Harmonization: Good institutional relationships and consistent and clear dialogue between the Provincial Directorates of Health and Abt was of paramount importance for the success of the IRS campaign. Greater involvement by the National Malaria Control Program and the PDHs in the planning, training and supervision stages is needed to increase government's ownership and build capacity to implement future IRS.
- Evaluation meetings were very important for providing essential recommendations for planning and strategizing for the next IRS campaign.
- The forum of journalists against malaria was fundamental to supporting community mobilization through the spray campaign; a greater number of journalists would have had greater impact. Adding other community groups such as church groups, scouts, and youth groups will continue to strengthen community awareness and acceptance of IRS as a key to malaria prevention, and encourage people to open their homes for spraying.
- Municipal and community leaders must play a greater role in sensitizing their communities to accept IRS, and to ready their homes for the spray teams.
- The data collection process and entry will require additional training and practice mobilization, and spray campaign team leaders and supervisors will be required to review the forms more closely for accuracy before signing off and before submission to the provincial coordinators.
- In an effort to increase data quality assurance, AIRS Angola will complete an internal Post-Spray Data Quality Audit to validate spray coverage and the proportion of people protected by the spray round. A new protocol for the audit will be designed to select a representative probability sample of structures to evaluate data.
- The number of data entry clerks must be increased and they should begin entering spray details in "real time" to ensure more-timely M&E data for submission of the End of Spray Report. To ensure close supervision of and more guidance to data entry clerks (DECs), data centers will include an M&E coordinator.

# 10. RECOMMENDATIONS

- There is a need for local capacity-building in environmental compliance issues. Government officers from agriculture and environment should be trained in environmental compliance for IRS.
- Although the local ownership in IEC was visible, the IRS program should continue to encourage the local health authorities and NMCP to own additional IRS activities and accept more responsibility. One example would be to transfer leadership for the ToT for spray operators.
- Because mosquitoes may not always be available for quality assurance and susceptibility testing, a more functional insectary (e.g., an insectary in-a-box, as has been done in other countries) should be put in place at the AIRS central office.
- The next spray campaign should start on October 1 or earlier, to avoid worker absenteeism during workers' school exams and lack of access to hard-to-reach locations due to the rainy season.
- The number of hours spray teams are in the field should be increased as the climate is favorable. This would help shorten the spray campaign, leading towards cost savings.
- The AIRS Angola team and the local governments and community leaders must work very closely together to ensure that recruitment is timed to meet the IRS campaign's needs and seasonal personnel are selected from the spray areas.

# ANNEX A:

**TABLE A-1: POST-SPRAY CAMPAIGN INSECTICIDE, PPE AND SUPPLIES INVENTORY**

| S/N | Item Description | Initial Stock (Transferred from Previous Contractor) | Additional Supply Quantity | Total In Stock | Total Consumption | Total Damaged | Total Missing | Stock Balance | Notes |
|---|---|---|---|---|---|---|---|---|---|
| 1 | Overalls | 1218 | 300 | 1518 | | 427 | 1 | 1517 | Most, if not all damaged overalls can be repaired (torn seams, etc.) |
| 2 | Boots | 617 | 108 | 725 | | 46 | 9 | 670 | Damaged boots are beyond repair |
| 3 | Helmets | 727 | 150 | 877 | 0 | | 0 | 877 | |
| 4 | Visors | 727 | 200 | 927 | | 280 | 0 | 927 | for repair |
| 5 | Visor Brackets | 727 | 200 | 927 | | | 0 | 927 | |
| 6 | Reflective Vests | 185 | 75 | 260 | | 130 | 0 | 260 | for repair |
| 7 | Gloves | 3035 | 2000 | 5035 | 2445 | | 0 | 2590 | |
| 8 | Masks | 22020 | 27520 | 49540 | 22530 | | 0 | 27010 | |
| 9 | Socks | 0 | 1765 | 1765 | 0 | | 1136 | 629 | |
| 10 | Spraying Pumps 8L | 657 | 0 | 657 | 0 | | 0 | 657 | |
| 11 | Spraying Pumps 10L | 116 | 0 | 116 | 0 | | 0 | 116 | |
| 12 | Water Container (500L) | 1 | 0 | 1 | | 1 | 0 | 0 | 7 years old - beyond repair |
| 13 | Water Container (2000L) | 2 | 0 | 2 | 0 | | 0 | 2 | |

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| 14 | Water Container (2500L) | 1 | 0 | 1 | 0 | | 0 | 1 | |
| 15 | Water Container (5000L) | 2 | 2 | 4 | 0 | | 0 | 4 | |
| 16 | Generators | 2 | 1 | 3 | 0 | | 0 | 3 | |
| 17 | Basins | 37 | 12 | 49 | 0 | | 0 | 49 | |
| 18 | 200L Metallic Drums | 4 | 0 | 4 | 0 | | 0 | 4 | |
| 19 | 200L Plastic Drums | 13 | 14 | 27 | 0 | | 0 | 27 | |
| 20 | 100L Plastic Drums | 49 | 0 | 49 | | 2 | 0 | 47 | beyond repair |
| 21 | 2L Jars | 28 | 0 | 28 | 0 | | 0 | 28 | |
| 22 | 10L Buckets | 0 | 130 | 130 | 0 | | 0 | 130 | |
| 23 | Fire Extinguishers | 0 | 8 | 8 | 0 | | 0 | 8 | |
| 24 | Pallets | 65 | 30 | 95 | 0 | | 0 | 95 | |
| 25 | Warehouse Shelves | 5 | 3 | 8 | 0 | | 0 | 8 | |
| 26 | Megaphones | 0 | 22 | 22 | 0 | | 0 | 22 | |
| 27 | Back Packs | 174 | 537 | 711 | 202 | | 0 | 509 | beyond repair |
| 28 | Plastic Chairs | 19 | 24 | 43 | 0 | | 0 | 43 | |
| 29 | Fans | 0 | 6 | 6 | 0 | | 0 | 6 | |
| 30 | Pens | 0 | 6000 | 6000 | 5800 | | 0 | 200 | |
| 31 | Markers | 0 | 7500 | 7500 | 7010 | | 0 | 490 | |
| 32 | First Aid Kit Container | 0 | 43 | 43 | 0 | | 2 | 41 | |
| 33 | Plastic Containers | 0 | 12 | 12 | 0 | | 0 | 12 | |
| 34 | Brooms | 0 | 12 | 12 | 0 | | 0 | 12 | |
| 35 | Calculators | 2 | 45 | 47 | 31 | | 0 | 16 | |
| 36 | Provets | 10 | 0 | 10 | 0 | | 0 | 10 | |
| 37 | Towels | 0 | 500 | 500 | | | 153 | 347 | |
| 38 | Ladder | 1 | 0 | 1 | 0 | | 0 | 1 | |
| 39 | Strainers | 1752 | 0 | 1752 | 0 | | 0 | 1752 | |
| 40 | Spray Pump Repair Kits | 1 | 30 | 31 | 0 | | 0 | 31 | |
| 41 | Thermometers | 2 | 3 | 5 | 0 | | 0 | 5 | |
| 42 | Complete Nozzle Assembly | 423 | 0 | 423 | 0 | | 0 | 423 | |

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| 43 | Nozzle Flow Regulators | 100 | 425 | 525 | 0 | | 0 | 525 | |
| 44 | Nozzle Gaskets Polyethylene | 1000 | 0 | 1000 | 0 | | 0 | 1000 | |
| 45 | Scale | 1 | 0 | 1 | 0 | | 0 | 1 | |
| 46 | Soap Bar | 0 | 288 | 288 | 257 | | 0 | 31 | |
| 47 | Soap Powder Sachets | 0 | 1500 | 1500 | 1289 | | 0 | 211 | |
| 48 | Batteries | 0 | 240 | 240 | 0 | | 0 | 240 | |
| 49 | Flashlights | 0 | 5 | 5 | 0 | | 0 | 5 | |
| 50 | 40" Container | 1 | 0 | 1 | 0 | | 0 | 1 | |
| 51 | Padlock | 10 | 9 | 19 | 0 | | 0 | 19 | |
| 52 | Pump Hangers | 0 | 5 | 5 | 0 | | 0 | 5 | |
| 53 | Wooden Benches | 12 | 0 | 12 | 0 | | 0 | 12 | |
| 54 | Flipcharts | 0 | 6 | 6 | 0 | | 0 | 6 | |
| 55 | White boards | 4 | 6 | 10 | 0 | | 0 | 10 | |
| 56 | Insecticides | 11325 | 100050 | 111375 | 78534 | | 0 | 35046 | 100,050 assumed 150 sachets per case; physical count of all remaining Insecticide Stock accounted for an additional 2,207 sachets. |