PMI | Africa IRS (AIRS) Project

Indoor Residual Spraying (IRS 2) Task Order Six

ZAMBIA 2015
END OF SPRAY REPORT

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ZAMBIA 2015
END OF SPRAY REPORT

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ACRONYMS

AIRS	Africa Indoor Residual Spraying
BCC	Behavior Change Communication
CEHO	Chief Environmental Health Officer
CHW	Community Health Worker
COP	Chief of Party
CSO	Central Statistical Office
DCMO	District Medical Officer
DFID	(UK) Department for International Development
DHMT	District Health Management Team
DCV	Data Collection Verification
DEC	Data Entry Clerk
DEV	Data Entry Verification
EC	Environmental Compliance
ECO	Environmental Compliance Officer
EE	Error Eliminator
HCC	Health Center Committee
HLC	Human Landing Catch
IEC	Information, Education and Communication
IRS	Indoor Residual Spraying
IRTAC	Insecticide Resistance Technical Advisory Committee
IVM	Integrated Vector Management
M&E	Monitoring & Evaluation
MCDMCH	Ministry of Community Development, Mother and Child Health
MMI	Macha Malaria Institute
MOH	Ministry of Health
MOP	Malaria Operational Plan
MSL	Medical Stores Limited
NMCC	National Malaria Control Centre
NMCP	National Malaria Control Program
PMI	President's Malaria Initiative
PMO	Provincial Medical Officer

PC	Provincial Coordinator
PPE	Personal Protective Equipment
PSC	Pyrethrum Spray Catch
PSECA	Pre-Season Environmental Compliance Assessment
SEA	Supplemental Environmental Assessment
SOP	Spray Operator
TL	Team Leader
TOT	Training of Trainers
USAID	United States Agency for International Development
WHO	World Health Organization
ZEMA	Zambia Environmental Management Agency

EXECUTIVE SUMMARY

The President's Malaria Initiative (PMI) has funded indoor residual spraying (IRS) in Zambia since 2008 with the aim of reducing the malaria burden, especially among children less than five years old and pregnant women. In August 2014, Abt Associates was awarded a three-year Africa-wide IRS project called The PMI Africa Indoor Residual Spraying (AIRS) project, funded by the United States Agency for International Development (USAID) under PMI. With PMI support, Zambia sprayed 15 districts in 2008 and gradually scaled up to 25 districts in 2011. In 2014, the number of IRS districts increased to 40 as a result of more funding from the UK Department for International Development (DFID) through PMI.

Implementation of Zambia's IRS program in 2015 was built upon lessons learned as the country entered its eighth year of PMI support for IRS. AIRS Zambia continued to implement IRS in the same five provinces as in 2014, Central (4 districts), Eastern (9 districts), Luapula (10 districts), Muchinga (7 districts) and Northern (9 districts). Lunga district, which was sprayed in 2014, was not sprayed in 2015 due to environmental compliance issues. The district is located in wetlands and pre-spray environmental compliance assessments recommended dropping the district from IRS.

The IRS campaign started on September 28th and ended on November 25th. The start dates for the 2015 IRS campaign in Zambia were staggered to allow the AIRS team to be in the field and supervise the logistic activities for the start of the campaign. In an effort to reduce costs and make IRS operations more efficient, the number of spray days was reduced to 51 days in 2015 from 65 days in 2014. While the number of seasonal staff, such as spray operators (SOPs), increased during the shorter spray period, the number of vehicles stayed the same and they were used more efficiently, by making multiple trips per day. Supervision levels for SOPs remained the same to assure high spray quality. This was accomplished by increasing the total number of supervisors to maintain the ratio of one supervisor for every five SOPs. SOP coverage reporting was monitored on a daily basis.

Local temporary staff were recruited and trained for the 2015 spray operations well before the start of the campaign. Logistics and environmental compliance assessments were carried out to ensure that the standard operating procedures and Best Management Practices (BMP) were followed. Stakeholder, partner planning, and community sensitization meetings were also held in order to create the necessary awareness and effective involvement of all stakeholders for successful spray operations.

A total of 547,548 structures were targeted to be sprayed in the five provinces and the targeted population was 2,689,782. By the end of IRS operations, day 51 of the campaign, AIRS Zambia found 549,520 structures. A total of 519,598 structures were sprayed yielding a spray coverage of 95%. A total of 2,544,290 people were protected by IRS, including 67,107 pregnant women and 392,903 children under five years old.

AIRS Zambia experienced some challenges during the campaign in Chipata District. The quality of supervision was below par and this threatened the quality of IRS. AIRS Zambia reported the problem to the local PMI team and the NMCP. Immediate measures were taken including engaging the nearby district IRS team that had finished spraying to provide extra support to the team in Chipata. Three Master Trainers and two senior AIRS staff were deployed to Chipata to support the district in supervision of IRS implementation.

TABLE 1: AIRS ZAMBIA 2015 IRS CAMPAIGN SUMMARY

Source of Funding	PMI	DFID	PMI & DFID
Number of supported provinces	3 (Eastern, Northern, Muchinga)	2 (Luapula, Central)	5 (Eastern, Northern, Luapula, Central, Muchinga)
Number of districts covered by IRS	25	14	39
Number of structures targeted by IRS	365,637	181,911	547,548
Number of structures found by IRS	379,874	169,646	549,520
Number of structures sprayed by IRS	358,256	161,342	519,598
2015 spray coverage	94%	95%	95 %
Population protected by IRS	1,695,921 (260,896 children <5 years, 43,137 pregnant women)	848,469 (132,007 children <5 years, 43,137 pregnant women)	2,544,290 (392,903 children <5 years, 67,107 pregnant women)
Dates of IRS campaign	September 28 – November 25, 2015	September 28 – November 25, 2015	September 28 – November 25, 2015
Length of campaign	51 days	51 days	51 days
Number of people trained with funds to deliver IRS[1]	1,221	691	1,912

[1] This figure only covers spray personnel (i.e. spray operators, team leaders, supervisors, clinicians.)

1. Country Background

IRS was conducted in Zambia in the Copperbelt beginning in the 1930's. However, by the 1980's, IRS in Zambia had ceased. It was re-launched in 2003. PMI has been supporting IRS in Zambia since 2008. Beginning in 2011, a change in malaria incidence left the eastern half of the country with the highest burden and prompted a shift to implement IRS in 20 districts in this area. Initially districts sprayed more structures because more resources were available but the country switched to targeted spraying in 2014 to cover high risk areas in line with NMSP 2011-2016. IRS in the eastern half of Zambia is funded by PMI and DFID.

In July, 2015, PMI, AIRS Zambia and the Zambia Ministry of Health (MOH) agreed to conduct IRS in 39 high-burden malaria districts in five provinces. This is one district less than was sprayed in 2014. Lunga, in Luapula Province, was dropped from the 2015 spray campaign. The five provinces in which IRS was implemented were Central (4 districts), Eastern (9 districts), Luapula (10 districts), Muchinga (7 districts) and Northern (9 districts) with a total of 547,548 structures planned. A total of 519,598 structures out of 549,520 structures found in the 39 districts were sprayed from September 28 – November 25 using an organophosphate insecticide (Actellic 300 CS). The total number of eligible structures enumerated in the 39 districts was 972,774[2] hence the total target structures represented 56% of all sprayable structures in the target districts. A detailed list of the total number of structures enumerated in each of the district is attached in Annex 2. The catchment areas were selected based on a number of factors including high malaria prevalence, based on malaria cases reported in both 2013 and 2014 from the health facilities serving the catchment areas, and population/structure density.

Working in collaboration with the MOH and the Ministry of Community Development, Mother and Child Health (MCDMCH), AIRS Zambia was tasked to achieve at least 85 percent spray coverage in the IRS target areas. In addition, AIRS Zambia provided technical support in the following activities:

- Training, capacity building, and advocacy at the national and district level as a means of achieving IRS sustainability. This included building the capacity of government officials and partners to undertake high-quality IRS.
- Daily monitoring of the IRS program via supervision of data collection and data entry using the AIRS Access database and the M&E supervisory tools, plus the mSpray platform, developed by Akros, which was used in seven districts in Luapula.
- Logistics assessments and coordination of all procurements, delivery, and storage of spray pumps, spare parts, insecticides, and personal protective equipment (PPE).
- Safe and correct insecticide application, thus minimizing human and environmental exposure to IRS insecticides, in compliance with the Pesticide Evaluation Report and Safer Use Action Plan (PERSUAP) and Supplemental Environmental Assessment (SEA).
- Coordination of sensitization and mobilization activities using door to door mobilization and radio announcements to raise the populations' awareness and acceptance of IRS and to encourage ownership.
- Conduct entomological surveillance including assessing malaria vector density and species

[2] These are estimated figures obtained from the enumeration exercise conducted by Akros. A few figures that were not available from the Akros enumeration were obtained from the District Medical Offices.

composition in intervention areas; establish vector feeding time and location; monitor the quality of insecticide application and insecticide decay rates and assess vector susceptibility.

- Maintenance of the entomological laboratory to ensure that all necessary studies can be carried out throughout the year.

The following map shows the locations of IRS target provinces and districts.

FIGURE 1: MAP OF ZAMBIA SHOWING AREAS OF IRS IMPLEMENTATION IN GREEN

2. Pre-Season Activities

2.1 Selection of IRS Districts and Catchment Areas

Forty districts in the Central, Eastern, Luapula, Muchinga and Northern provinces were selected for IRS in 2014. These same districts received IRS in 2015, except for Lunga district, which was dropped. The 2014 selection criteria were based on the following:

- malaria burden
- population density
- structure density
- available resources
- consideration of universal coverage of ITNs as the primary vector management intervention

Unlike in 2014, AIRS Zambia supported the districts to conduct a thorough review of the location of IRS target areas in 2015 to ensure that they were accessible and operationally feasible. The result of the review and subsequent modification of the location of target areas included adding small pockets of communities that were left out of the initial targeting exercise. Some communities are located in between two target areas, they are similar in topography to their neighboring target communities and IRS vehicles must drive through them anyway. In addition, small communities that are located in isolated areas far from a main road were not targeted because it would take a large amount of resources and time to spray a few structures.

District teams were engaged throughout the process, as described below. In the northern half of Luapula Province where most of the structures are located along the Luapula River and Lake Mweru, all of these structures were targeted for spraying. As a result, the overall number of structures targeted increased.

FIGURE 2: MAP OF ZAMBIA SHOWING MALARIA PREVALENCE, 2006 - 2012

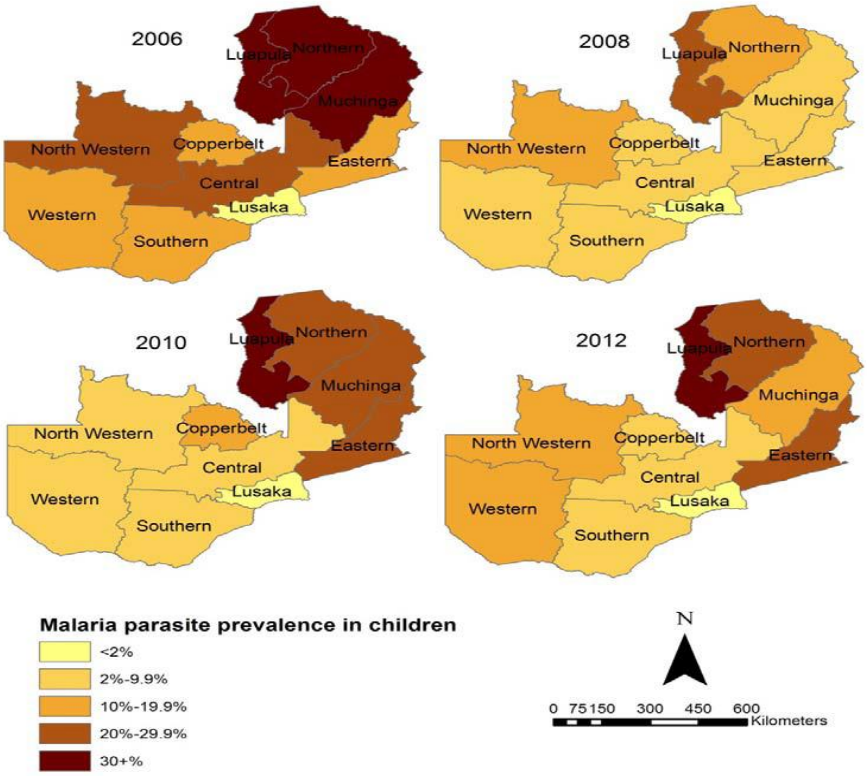


FIGURE 3: MAP OF ZAMBIA SHOWING MALARIA PREVALENCE, 2012 - 2015

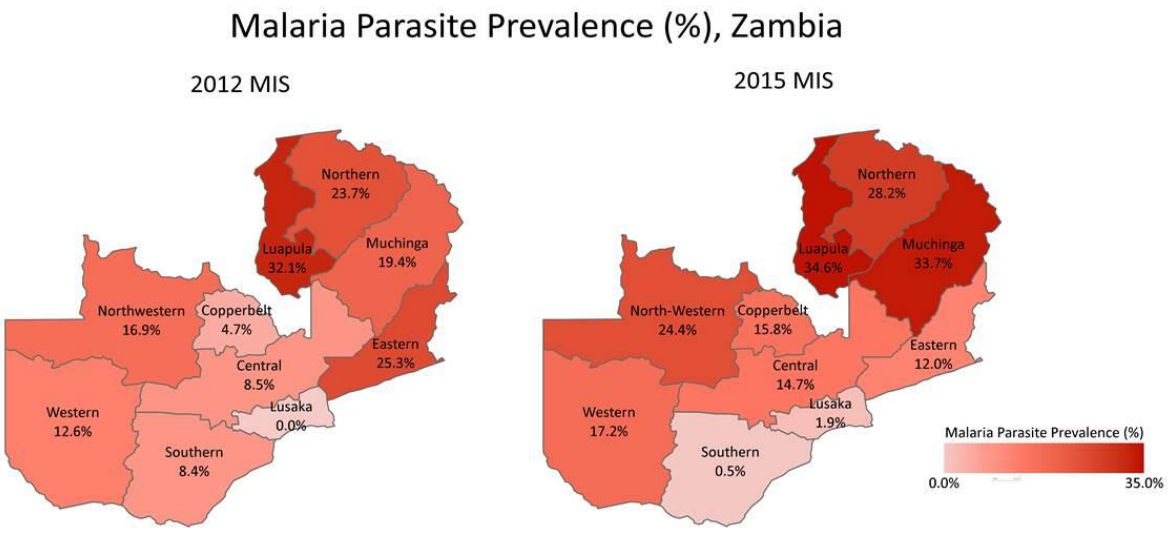


Table 2 shows a summary of the number of target structures in the 39 districts.

TABLE 2: PLANNED STRUCTURES FOR 2015 IRS

Province	Number of Districts	Number of Target Structures
Central	4	15,750
Eastern	9	174,841
Luapula	10	166,161
Muchinga	7	65,903
Northern	9	124,893
Total	**39**	**547,548**

2.2 Selection of Catchment Areas in PMI Districts

Micro planning meetings were held at the district level to support them with the selection of catchment areas in Eastern, Muchinga, and Northern provinces. Each district listed the number of catchment areas by number of structures, population and by malaria incidence per catchment area. The catchment areas were ranked in descending order starting with the highest malaria incidence. The districts selected the number of structures for spraying in 2015 based on accessibility, practicability, the availability of resources, existing IVM interventions and population. Using the total number of structures, the districts worked out the number of days for implementation, as well as the number of spray operators, team leaders, and supervisors needed for the spray campaign.

2.3 Selection of Catchment Areas in DFID Districts

In the DFID-supported districts in Central and Luapula provinces, with technical support from Akros, the following steps were carried out:

1. Establishing where structures are through enumeration using google maps.
2. Determining 'spray areas' based on population density using enumerated structures and minimum structures per settlement.
3. Determining a malaria burden 'ranking' for all target areas across the 14 districts.
4. Determining the number of structures that can be sprayed per district given the available resources.
5. Based on evidence and local knowledge from the districts, deciding on the final spray areas.

In 2015, 180,395 structures were targeted to be sprayed in the 14 districts as compared to 2014 when only 125,000 were targeted. This is an increase of 55,395 structures. A similar process was used to review the operational feasibility and topography of communities close to each other and include those areas when possible.

2.4 District Planning Meetings

Three micro-planning meetings with provincial and district authorities were held in three provinces from May - July 2015. Participants attended micro-planning meetings in selected venues of the province. In the

Eastern Province, the meeting was held in Chipata, while for Northern and Muchinga provinces, the meetings were in Mpika. The micro-planning meeting for Luapula and Central provinces was held in Samfya. In each of the provincial meetings, a three-day planning meeting was organized to discuss and develop an IRS operational plan with district teams. The issues discussed during the micro-planning meetings included:

- Timing of spray operations
- Spray campaign duration (# of days)
- Insecticide selection
- Procurement and logistics
- Spray performance target
- Monitoring and supervision plan
- Recruitment of spray operators
- Commencement date for spray operations
- The role and responsibilities of stakeholders before, during and after spray operations

2.5 Insecticide Selection

An organophosphate, pirimiphos-methyl (Actellic 300 CS), was used during the 2015 IRS campaign in the 39 districts. The selection was based on data obtained from insecticide susceptibility assays that were carried out in 2014 and 2015.

Zambia has a rigorous insecticide resistance management (IRM) structure that supports entomological studies on which insecticide selection is based. The Insecticide Resistance Technical Advisory Committee (IRTAC) that comprises representatives from the Tropical Diseases Research Centre (TDRC), the Macha Malaria Institute (MMI), the University of Liverpool, Johns Hopkins University, Centre for Disease Control, AIRS Zambia, PMI and the National Malaria Control Centre (NMCC) reviews the entomological studies that are carried out and makes recommendations to the Insecticide Resistance Management Technical working group that selects the insecticide of choice. This decision was based largely on the susceptibility of the local vectors and residual effect of insecticides. When choosing an insecticide for IRS, its effectiveness on the target vector species and its safety for inhabitants, workers, animals, and environment are the two most important elements. In addition, the residual effect of the insecticide is essential to guide malaria managers to make evidence-based decisions.

2.6 Logistics Needs and Procurement

For efficiency and effectiveness in conducting the logistics assessment, AIRS organized three teams to be responsible for providing technical support to the districts during the logistics assessment for the 2015 IRS season. The logistics assessment team was comprised of at least one AIRS Senior Management Team member, the Chief Environmental Officer from the respective province, and an experienced Public Health Officer from the chosen district. Note that at this time, the District Coordinator position was not yet established.

The process involved discussions with the District Commissioners (DCs), who are the political heads in the districts and district health officials (District Medical Officer, Planning Manager, Malaria Focal Person, and IRS Manager). In order to standardize the collection of data in the field, an IRS needs assessment checklist was used.

The following activities were carried out:

- Holding meetings with the district health office teams to discuss district readiness for the IRS campaign
- Reviewing previous coverage
- Reviewing the district plans to ensure the inclusion of all IRS activities and the costs that go along with the activities.
- Assisting districts in strategizing how to identify potential partners and engage all stakeholders in IRS activities.
- Quantify the IRS commodities required for 2015 spray season. The AIRS Zambia team made local and international procurements using an open tender process. The commodities which were procured are tabulated in 2.6.1.

2.6.1 PROCUREMENT

Procurement for commodities to be used in the 2015 IRS campaign was divided into two- international and local procurements. All items that were available in Zambia were procured locally which ensured cost effectiveness and the timely delivery of the commodities. In total, 140,140 bottles of Actellic were available for use in the 2015 spray operations: 45,000 bottles were procured in 2015; 70,000 bottles were donated to AIRS by the MOH; 25,140 bottles were left over from the 2014 campaign of which 19,728 were expiring in June 2015 with the rest having a good shelf life (expiring in December 2015)". It should be noted that Syngenta replaced the 19,728 bottles that had expired.

A consignment of PPE, including 361 pumps, 40 repair kits, 101 hard hats, 150 brass cylinders,150 plungers, 150 filter nylons, 250 pressure gauges and 1,020 nose masks were received at the project office in Lusaka on August 23, 2015. Another package containing 361 control flow valves and 1,075 nozzles was received on September 20, 2015.

The tables below show the commodities that were procured internationally and locally. These quantities were based on the number of SOPs for 2015 and the balance brought forward from the 2014 spray campaign.

TABLE 3: INTERNATIONAL PROCUREMENTS

Item	Quantity before the campaign	Quantity procured	Total	Quantity Used	Quantity Damaged	Quantity remaining after campaign
Spray Pumps (Hudson)	1,055	361	1,416	1,416	743*	673
Hard Hats	2,253	101	2,354	2,354	0	2,354
Face Shields	340	692	1,032	1,032	980	52
Nose Masks	20,400	1,020	21,420	19,510	19,510	1,910

Actellic 300 CS (bottles)	5,412	45,000	140,140 (includes 70,000 from the MOH and 19,728 from Syngenta)	136,652	-	3,488
Pressure Gauges (for pumps)	0	250	250	250	0	250
Repair Kits (for pumps)	0	40	40	40	-	40

* will be repaired before the next spray campaign begins

TABLE 4: LOCAL PROCUREMENTS

Item	Quantity Before the Campaign	Quantity Procured	Total	Quantity Used	Quantity Damaged	Quantity remaining after campaign
Overalls	1,771	1,240	3,011	3,011	234	2,777
Boots (pairs)	1,285	656	1,941	1,941	12	1,929
Fire Extinguishers	4	44	44	44	0	44
Daily SOP card	0	44,094	44,094	44,094	0	0
Mobilization Cards	0	41,121	41,121	41,121	0	0
Error Elimin. Forms	0	2,901	2,901	2,901	0	0
Heavy Duty Gloves	0	4,549	4,549	4,549	4,549	0
IEC Brochures	0	30,000	30,000	30,000	0	0
Posters	0	9,000	9,000	9,000	0	0
Team Leader Forms	0	9,755	9,755	9,755	0	0

Spray bags	0	1,494	1,494	1,494	0	0
IRS Cards	0	715,858	715,858	715,858	0	0
Team Leader Forms	0	9,755	9,755	9,755	0	0
Data Collection forms	0	13,898	13,898	13,898	0	0
Socks	95	2,718	2,813	2,742	2,742	71
Cloths	552	8,226	8,778	7,884	-	894
Face Towels	13	8,226	8,239	8,217	8,217	22

All insecticides for the 2015 spray campaign were received and stored at Central Medical Stores Limited (MSL) while the PPE was stored at the NMCC in Lusaka ready for distribution. AIRS Zambia used NMCP trucks to distribute the IRS commodities before the start of the IRS campaign.

2.7 HR REQUIREMENTS

At the district level, human resource requirements consisted of two categories: (I) permanent staff who include the following: District Coordinators (DCs), the IRS Managers, Supervisors and Store Keepers and (II) seasonal workers who include the following: Monitoring and Evaluation (M&E) Assistants, Data Entry Clerks (DECs), Team Leaders (TLs), Spray Operators (SOPs) and Washers. Kindly note that the IRS Managers, Supervisors and Store Keepers are Government employees while DCs are AIRS employees. In addition, some Neighborhood Health Committee members, Community Health Volunteers and individuals who could read and write were engaged by AIRS Zambia to carry out house-to-house mobilization activities. Human resources were also engaged to carry out entomological activities, such as mosquito collectors and supervisors.

2.7.1 SEASONAL STAFF HIRED

For the 2015 spray season, AIRS Zambia hired the following seasonal staff to help with the implementation of IRS in the target districts.

TABLE 5: NUMBER OF PERSONS HIRED

Categories of Persons Hired	Number of staff hired to Support IRS						Total
	Spray Ops		Data Capture		Support		
	M	F	M	F	DFID	PMI	
Spray Operators & Team leaders	1,141	478			599	1,020	**1619**
Data Entry Clerks			28	21	13	36	**49**
M&E Assistants			30	11	15	26	**41**

TOTAL M/F	1,141	478	**58**	**32**	627	1082	1,709
TOTAL	**1,619**		**90**				

2.7.2 IRS TRAININGS

IRS is a highly technical process and demands vigorous and thorough training of all personnel involved in order to achieve the intended impact. Training of all the personnel involved in IRS is done by AIRS Zambia in collaboration with the District Health Management Teams and is conducted annually before the commencement of spray operations. These trainings are meant to provide specific skills to personnel involved in the IRS campaign so that they are able to spray structures correctly. In all, six different trainings were organized to ensure that all staff was prepared for the 2015 spray campaign.

The trainings were organized in to the following categories:

- Training of Trainers (TOT)
- Training of SOPs
- Training of M&E Assistants
- Training of Data Entry Clerks
- Training of Store Keepers
- Training of Mobilizers

The materials for trainings covered the following topics:

- Introduction to malaria prevention and control;
- IRS micro-planning, scheduling and logistics management;
- Spray techniques and processes;
- Spray coverage targets;
- Environmental compliance and personal safety;
- Advocacy and social mobilization;
- IRS data collection; and
- Supervision of IRS activities.

2.7.3 TRAINING OF TRAINERS

Three TOTs were organized in the provinces in collaboration with NMCP between June and July 2015. The first training was conducted for districts in Northern and Muchinga provinces and was held in Mbala, while the second was conducted for districts in Eastern Province and was held in Petauke. The last TOT was conducted for districts in Central and Luapula provinces and was held in Mkushi. In order to increase the pool of trainers in the districts, two or three participants were trained from each district. A total of 182 (144 males and 38 females) supervisors were trained. The trainings were conducted by master trainers who have been developed over the years. All the participants are Environmental Health Technicians and are government workers. The participants included district IRS managers and one or two supervisors for each of the 39 districts. After the TOT, the participants returned to their respective districts to conduct IRS training for SOPs and team leaders (TLs). The number of trainers used in each district was based on the number of participants to be trained.

TABLE 6: NUMBER OF TOT PARTICIPANTS, BY GENDER

Support	Province	Number of Participants		Total
		Male	Female	
PMI	Eastern	68	21	89
	Northern	24	5	29
	Muchinga	17	1	18
DFID	Luapula	27	6	33
	Central	8	5	13
Total		**144**	**38**	**182**

2.7.4 SOP Cascade Training

The cascade training is organized to train SOPs and TLs and it's conducted in close collaboration with district and provincial officials. All of the SOPs and TLs were selected by the districts and they underwent a thorough medical examination in their respective district hospitals to ensure that they were medically and physically fit to perform IRS activities. All female SOPs and TLs were also screened for pregnancy.

The selection criteria required to be a SOP or TL was:

- Physically and medically fit;
- Be 21 years or above in age;
- Be able to read and write;
- Residing in the district at the time of selection.

The SOPs and TLs were taken through an intensive ten day theory and practical sessions which covered the following topics:

- Introduction to malaria control;
- Spray techniques;
- Handling and managing insecticides;
- Handling and maintaining spray pumps;
- Personal and environmental safety;
- Leading a spraying team;
- Data collection and filling out data collection forms; and
- Basics of IEC for IRS.

A total of 1,653 SOPs (1,142 males and 511 females) were trained. The details are provided in Table 7.

TABLE 7: NUMBER OF SPRAY OPERATORS TRAINED TO IMPLEMENT IRS

Support	Province	Training Sites	Spray Operators		
			Male	Female	Total
PMI	Eastern	9	310	178	488
	Muchinga	7	132	76	208
	Northern	9	244	97	341
DFID	Central	4	75	31	106
	Luapula	10	381	129	510
Total		**39**	**1,142**	**511**	**1,653**

2.7.5 Data Collection Training

The AIRS Zambia team, led by the M&E Manager and the Database Manager, facilitated data collection training sessions during the TOT for IRS managers and supervisors, as well as some of the data collection trainings for SOPS and TLs. The M&E Manager and the Database Manager also led the training for M&E Assistants and Data Entry Clerks (DECs), with short-term technical assistance from the home office M&E Specialist. The training focused on the following key topics:

- Familiarity with data collection forms (SOP and TL forms, and the AIRS supervisory toolkit);
- Understanding key IRS definitions (e.g. eligible structure) and indicators;
- Supervisory roles and responsibilities;
- Reviewing collected data and spotting irregularities;
- Timely, consistent, and accurate reporting;
- Setting appropriate and realistic reporting timelines;
- Establishing a backup reporting/ communication protocols;
- AIRS database and security protocols; and
- Data quality assurance and control.

In total, 68 DECs and 46 M&E Assistants were trained to be hired for the 2015 IRS campaign. Ultimately 49 DECs and 41 M&E Assistants were hired out of the total number of people trained.

2.7.6 Logistics Training

The IRS logistics standard operating procedure manual is available for use by all IRS commodity managers at different levels in the IRS supply chain. This manual is intended to guide the storekeepers and IRS managers in their day to day activities pertaining to IRS logistics. Seventy-nine storekeepers were trained in the use of the IRS logistics standard operating procedures. The Store Keepers were trained in store management and inventory management.

TABLE 8: NUMBER AND TYPE OF SEASONAL TRAININGS

Categories of Persons Trained	Training on IRS Delivery												Total		Funding Source	
	Training of Trainers		Spray Operations		Data Capture		Mobilization		Logistics Training		Poison Control/ Adverse Events					
	M	F	M	F	M	F	M	F	M	F	M	F			DFID	PMI
IRS Managers	37	2											**39**		14	25
Supervisors (EHTs)	107	36											**143**		32	111
Mobilizers							1,692	716					**2,408**		653	1,755
Spray Operators			977	444									**1,421**			954
Team Leaders			165	67									**232**		83	149
Data Entry Clerks					40	28							**68**		20	48
M&E Assistants					34	12							**46**		17	29
District storekeepers									59	20			**79**		28	51
Clinicians											61	16	**77**		29	48
TOTAL M/F	**144**	**38**	**1,142**	**511**	**74**	**40**	**1,692**	**716**	**59**	**20**	**61**	**16**	**1,480**	**625**	**1,409**	**3,104**
TOTAL/Training	**182**		**1,653**		**114**		**2,408**		**79**		**77**		**4,513**			

3. Gender Awareness and Integration

As part of the gender strategy for year one, Zambia AIRS identified a Gender Focal Person who attended the Gender Awareness training which was conducted in April 2015 in Rwanda.

To ensure that other stakeholders receive IRS gender awareness information, AIRS Zambia presented the gender awareness programming strategy at the IRS Technical Working Group. This TWG comprises all stakeholders who are involved in IRS in Zambia which includes the NMCP, MACEPA, IRS Global Fund team, PMI/Zambia, and other stakeholders. After the presentation, it was clear that most participants appreciated the idea of integrating more women in the spray teams to improve spray coverage and to spray targeted structures in less time.

Moreover, AIRS Zambia took advantage of the capacity building training organized by Encompass to train AIRS staff and government counterparts in IRS gender awareness and integration. The capacity building training occurred from June 29 - July 6 and in total 89 participants attended, including 40 IRS Managers, 10 Master Trainers, 18 AIRS DCs, 10 AIRS Zambia staff from the Lusaka office, six NMCP staff and five Provincial Environmental Health Officers. All participants were trained on the need to increase the number of female participants on our spraying teams, hire more women in supervisory roles, ensure their safety and discuss the benefits derived from recruiting more women.

Prior to the 2015 IRS operations, AIRS Zambia actively ensured that more women were recruited in influential positions for the 2015 IRS campaign. The following was specifically done:

1. The IRS Managers and District Coordinators were given targets to ensure that more women were recruited in the influential positions.
2. During the pre-spray activities, interactive discussions were held to emphasize the need for more females to participate in IRS activities. Also, advertisements were sent out about upcoming vacancies and females were strongly encouraged to apply.

After this process, AIRS Zambia recorded an increase in the number of women who were trained and hired by the program to support IRS. In total 15 females were hired as DECs and M&E Assistants in 2014 representing about 20% of the total personnel hired as DECs and M&E Assistants. In 2015 there was a drastic improvement; 32 women were hired as female DECs and M&E Assistants representing 35% of the total personnel hired as DECs and M&E Assistants. The same story was true for supervisors who were hired by AIRS Zambia in 2015. The percentage of women who were hired as Supervisors increased from 16% in 2014 to 25% in 2015. This was a marginal increase but very important because the majority of EHTs who are eligible for the position of supervisors are men. To have 25% representation is a very good improvement. The percentage of women who were hired as a SOP dropped from 33% in 2014 to 30% in 2015. Even though it is only a 3% decrease, it is worrying because the project tried to hire more women. It is hoped that in 2016, the program will intensify this effort with messages to recruit more women SOPs. The program is very confident that in the next spray campaign the number will improve further.

4. Information, Education, and Communication

4.1 Introduction

The IEC component of the IRS program performs a major role in creating awareness and adequately mobilizing community members for spraying. Several strategies were employed to ensure successful operations. Some of these strategies included: stakeholder meetings, door-to-door mobilization, radio announcements and discussions. The engagement of beneficiaries, stakeholders and partners ensured open discussions that reached many people of different target groups and was aimed at improving acceptance. It is important to note that the IEC strategy was heavily strengthened in the large urbanized districts where IRS acceptance was low in 2014.

4.2 Door-to-Door Mobilization

Door-to-door mobilization commenced two weeks before the start of the 2015 spray campaign. The program trained and engaged a total of 2,408 mobilizers who were residents in the targeted communities. This enabled them to visit every household with IRS messages. The face-to-face interaction with households demystified and corrected any misconceptions about IRS and further educated households on their roles and responsibilities before, during, and after spray activities. The mobilizers also ensured that the community members were informed of spray dates for their communities. During the door-to-door mobilization, mobilizers collected household data on the number of people reached with IRS messages, provided each household with an IRS card and labeled the wall with a chalk to give a unique identity to the structures. This data helped provide an enumeration of the number of structures in a catchment area and was used to track and verify the number of structures visited. One of the main challenges during mobilization was that some mobilizers were going out of the target catchment areas, especially in areas where the borders for the catchment areas were not clear. Fortunately, this was not a very common problem.

4.3 Mass Media Communication

The Minister of Health launched the IRS spray campaign on national television and the radio. There were three main radio programming initiatives used in the 2015 IRS campaign: radio spots which are also called jingles, radio discussions (interactive shows) and announcements about IRS and its benefits. Radio spots started airing on September 21, 2015, a week before the start of spray operations and continued three times per day throughout the spray period. Discussions were centered on achieving the NMCP and PMI target of 85% per catchment area (coverage) and addressing other community concerns about spray activities. It also included messages about household preparation, safety, and compliance. These radio programs were conveyed in the local language to ensure the full understanding of community members and the general public. Monitoring of radio spots in terms of timing and adequate slots was successfully carried out by the DCs in their respective districts. In total there were 17 radio stations engaged for mass communication in all the five provinces, two per province except in the Eastern Province where there were eight radio stations and the Northern Province where there were three radio stations.

5. Implementation of IRS Activities

IRS implementation was carried out over a 51-day period from September 28 to November 25. A total of 547,548 structures were targeted to be sprayed in five provinces. The start dates were staggered by district and therefore the end dates varied from district to district. By the end of IRS operations, day 51 of the campaign, AIRS Zambia found 549,520 structures. A total of 519,598 structures were sprayed yielding a spray coverage of 95%. A total of 2,544,290 people were protected by IRS, including 67,107 pregnant women and 392,903 children under 5 years old. Table 9 below shows the start and end dates of the spray campaign for each district.

TABLE 9: SPRAY START AND END DATES BY DISTRICT

Province	District	Spray Details		
		No. Spray days	Spray Start Date	Spray End Date
Eastern	Chadiza	32	12-Oct	21-Nov
	Chipata	35	12-Oct	25-Nov
	Katete	35	12-Oct	19-Nov
	Lundazi	35	12-Oct	25-Nov
	Mambwe	29	12-Oct	06-Nov
	Nyimba	33	12-Oct	19-Nov
	Petauke	35	12-Oct	25-Nov
	Sinda	28	12-Oct	25 Nov
	Vubwi	28	12-Oct	13-Nov
	Chama	35	12-Oct	25-Nov
Muchinga	Chinsali	30	27-Sep	14Nov
	Isoka	25	28-Sep	05-Nov
	Mpika	25	28-Sep	28-Nov
	Mafinga	25	28-Sep	25-Nov
	Shiwang'andu	35	28-Sep	20-Nov
	Nakonde	15	29-Sep	24-Nov
Northern	Chilubi	35	28-Sep	23-Nov
	Kaputa	30	28-Sep	29-Nov
	Kasama	35	30-Sep	25-Nov
	Luwingu	35	28-Sep	21-Nov
	Mbala	33	5-Oct	07-Nov
	Mporokoso	30	28-Sep	07-Nov
	Mpulungu	30	28-Sep	20-Nov
	Mungwi	30	28-Sep	09-Nov
	Nsama	30	28-Sep	26-Nov
Luapula	Mansa	35	28-Sep	07-Nov
	Chembe	20	28-Sep	30 Oct

Province	District	Spray Details		
		No. Spray days	Spray Start Date	Spray End Date
	Chipili	20	28-Sep	16-Nov
	Samfya	35	28-Sep	13-Nov
	Mwense	35	28-Sep	07-Nov
	Kawambwa	33	28-Sep	17-Nov
	Mwansabombwe	20	28-Sep	07-Nov
	Nchelenge	35	28-Sep	16-Nov
	Chiengi	33	28-Sep	15-Nov
	Milenge	22	28-Sep	26-Oct
Central	Mkushi	30	28-Sep	26-Oct
	Luano	15	28-Sep	04-Oct
	Serenje	15	28-Sep	13-Oct
	Chitambo	15	28-Sep	07-Oct

5.1 IRS SUPERVISION

As previously mentioned, IRS is a highly technical process that demands thorough supervision and monitoring in order to achieve the intended impact. In 2014, supervision was inconsistent so AIRS Zambia ensured that there was adequate monitoring and supervision at all levels in 2015 throughout the different stages of the spray campaign (before, during and after). With the introduction of the position of the District Coordinator, supervision at the district level was improved. The DCs were instrumental in strategizing the deployment of SOPs and also coordinated the overall supervision. The DCs were provided with training to ensure that they had a solid understanding of IRS implementation and supervision. At the national level, the Chief of Party, the Deputy Chief of Party and the Operations Manager, were each assigned to specific provinces. The Chief of Party was in charge of the Northern Province, while the Deputy Chief of Party was in charge Luapula and Central provinces. The Operations Manager was in charge of Muchinga and Eastern provinces. The district teams were comprised of the DC, IRS Manager, Supervisors, the District M&E Assistants and TLs. Other technical staff from the AIRS Zambia team also joined the district teams for supervision. All teams used standardized AIRS supervision and monitoring tools to assess the spray quality, environmental compliance activities and spray data collection.

A monitoring and supervision schedule was developed and used during the 2015 spray campaign. The schedule showed the role of specific individuals, which site they were working from, the type of supervisory tools to be used and the frequency of the usage of each supervisory tool. The schedule captured the Chief of Party, Operations Manager, M&E Manager, Database Manager, and the ECO. It was through this intensified supervision that AIRS Zambia noticed challenges in Chipata District. Initially in Chipata District, the quality of supervision was below par and this threatened the quality of IRS. This was reported to the local PMI team and the NMCP. Some SOPs were caught spraying without removing kitchen utensils and others sprayed on food. Immediate measures were taken to ensure the kitchen utensils were washed thoroughly and contaminated food was not consumed but destroyed. To improve supervision immediate measures were also taken including engaging the nearby district IRS team from Mambwe District that had finished spraying to support the team in Chipata to spray. Three Master

Trainers and two senior AIRS staff were deployed to Chipata to support the district in supervision of IRS implementation,

At the district level, supervision was organized as follows:

- Each spray team was composed of five SOPs and was supervised by a team leader. In mSpray districts, each team was composed of three SOPs and was supervised by a team leader.
- Every three spray teams were under the supervision of a supervisor who reported to the government district IRS manager. The IRS Manager reported to the DCMO. Spray activities of all the districts in a province were coordinated by the AIRS DC who was a full-time AIRS staff.
- During the spray campaign 11 master trainers were engaged to support districts that had some supervision and monitoring challenges. These master trainers coordinated supervision and routine daily activities by working closely with district IRS Managers and other government district staff. They were in the field throughout the IRS campaign. SOP performance was monitored using the performance tracker that was compiled by the DC and submitted to the Operations Manager on a weekly basis.
- The DCs, Supervisors and IRS Managers met on a daily basis to review the daily progress and plan for the following day. When the team had some difficulties or any concerns pertaining to IRS operations that could not be dealt with at district level, these were communicated to the provincial coordinators immediately.

5.2 LOGISTICS

5.2.1 IRS STORAGE AND INSECTICIDE STOCK MANAGEMENT

The Logistics Manager was in charge of managing stock at the central level and provided overall supervision for the 78 Store Keepers under the program. Each district store was managed by two Store Keepers who are Government employees. All the districts had store rooms where all of the commodities were kept, however, there were a few districts, which used storage facilities that belonged to district councils and other well-wishers. These facilities were rented free of charge. All IRS commodities were stored according to the standard operating procedure for storage of IRS commodities. To enhance tracking of the insecticide usage, the IRS Daily Insecticide usage register was used to account for the quantity issued, quantity used and quantity returned. The register was also used to account for the number of empty bottles and the possible discrepancy between number of bottles used and the empty bottles brought by the SOPs.

TABLE 10: ACTELLIC CONSUMPTION, BY PROVINCE

Province	No. of Bottles
Central	3,344
Luapula	38,704
Northern	33,918
Muchinga	15,694
Eastern	45,348

Total	**137,008**

A total of 137,008 bottles of insecticide were used to spray 519,598 structures in the 39 IRS districts, with a utilization ratio of approximately 1:4.0 bottles to structures sprayed. This is higher compared to the 2014 IRS campaign where a total of 112,603 bottles of insecticide were used to spray 409,544 structures in the 40 IRS districts, with a utilization ratio of approximately 1:3.64 bottles to structures sprayed.

6. Post-Season Activities

6.1 Post-Spray Inventory

In order to ensure safe and effective completion of the spray season, the AIRS Zambia team completed post-spray activities. All IRS materials and equipment, remaining insecticides, and insecticide-contaminated wastes were returned to the district warehouses. All equipment was checked to see if it functioned properly. Broken equipment was identified and will be repaired before the start of the 2016 IRS campaign. All unsalvageable equipment, like plastic sheets, will be disposed of according to environmental compliance protocols. All remaining insecticides are currently stored according to instructions provided by PMI, NMCP and the Zambia Environmental Management Agency (ZEMA) at the district warehouse but they will be moved to the central warehouse for proper monitoring and storage. The quantity and functionality of all other IRS materials and equipment was checked and documented to help plan for the next spray season. All insecticide-contaminated waste generated from operations will be disposed of in ways compliant with environmental regulations using disposal facilities available in Zambia.

6.2 Post-Spray Review meetings

After the IRS campaign, a post spray review meeting is usually organized and attended by PMI, NMCP and other stakeholders. The all partners' meeting has been planned from January 19 to 20, 2016 in Kitwe. During this meeting, the operations, successes, challenges, lesson learned and recommendations during the last spray campaign will be discussed from which the way forward for the next campaign will be agreed.

7. Monitoring and Evaluation

M&E for the 2015 IRS campaign followed the processes outlined in the 2015 AIRS Zambia Work Plan. The AIRS M&E approach incorporated successful aspects of the M&E system and lessons learned from the 2014 IRS campaign as well as IRS M&E best practices from other AIRS countries.

7.1 Key Objectives

The key objectives of AIRS Zambia M&E activities were:

- To emphasize accuracy of both the data collection and the data entry process through comprehensive training and supervision at all levels;
- To streamline and standardize data flow, minimize error, and facilitate timely reporting;
- To ensure IRS data security and storage for future reference through the establishment and enforcement of proper protocols; and
- To document lessons learned and good practices observed in the implementation of the project activities and apply to future project years.

7.2 M&E System Development and Implementation

The AIRS Zambia M&E system was drafted and defined before the start of IRS implementation to ensure the collection, management, and reporting of high-quality data. As noted above, the Zambia team considered and adopted the successful aspects of M&E system from the 2014 AIRS IRS campaign. The first step was to adapt the Daily SOP Form to include the indicators that AIRS reports, such as vulnerable populations (e.g. pregnant women and children under five years) and population protected, by gender. The M&E team comprehensively explained the revised SOP form during the TOT training to IRS Managers and Supervisors so that they can also explain in detail during the cascade training for SOPs and TLs. The SOP form served as the primary tool for data collection. To support data collection and entry and the supervision of both, AIRS hired two kinds of staff to fill the M&E assistant and DEC positions respectively, in each of the 39 districts. AIRS Zambia also utilized the Client Technology Center (CTC) located at the Abt home office and the AIRS database which served as a tool for implementation and management to track key performance and output indicators. M&E and senior technical AIRS staff also used the database to generate "real-time" reports for quick feedback and to reconcile and prevent additional errors in data collection and entry.

Spray data was collected by SOPs, and verified by team leaders, supervisors, and M&E assistants. The M&E assistants handed over the forms to the data centers for entry. Data entry clerks (DECs) performed a final verification of spray data and manual arithmetic before updating the database. At the end of each day, the M&E team reviewed the data entry progress for all the districts and gave an update to the Home Office via email. The M&E team reviewed data entered for errors and addressed issues with DECs immediately. For quality control purposes and timely generation of weekly client spray progress reports, all data was expected to be delivered within 48 hours of spraying. However, in some instances, data was not entered or synced within 48 hours due to several reasons that included:

- Frequent internet outage by some mobile carriers in some districts
- SOPs would sometimes camp when they were spraying in far remote areas and in such instances DECs would either go camping with SOPs and enter data but not sync it until they returned to base where internet connectivity was available, or they would wait until SOPs were back to base to enter and sync the data

Daily SOP Forms were filed in binders according to spray date and team number at the data centers. A daily electronic back-up of spray data was created onto each computer hard disk and also to an external hard drive for data safety and storage.

7.3 mSpray Implementation

AIRS Zambia in partnership with Akros did make use of mobile devices for data collection and management (mSpray) in seven districts in Luapula province for the second year. The mSpray platform is a cloud-based data recording and management system that allows spray personnel to electronically collect spray data and GPS coordinates using a mobile phone or tablet. Data was submitted to a shared project folder, or cloud, for immediate viewing of spray campaign progress. The following is a list of key features of the mSpray tool for data collection and management:

- Data captured directly on mobile forms that are loaded onto a smartphone or tablet
- Pre-programmed data entry controls on mobile devices reduce illogical data errors
- Real-time data availability via a shared, cloud-based monitoring and reporting platform to immediately address campaign challenges and improve spray progress

7.3.1 Lessons Learned and Challenges

7.3.1.1 Lessons Learned

- Using mSpray maps to determine spray coverage and plan the next target areas proved to be of good help to the IRS managers during IRS operations, in some districts.
    - Though mSpray enabled IRS managers/supervisors to verify the actual point of data collection through its map feature, it was not fully functional at the beginning of the campaign because these maps were not loaded on the tablets on time.
    - mSpray is able to map IRS spraying via a visualization tool that provides near real time feedback on spray coverage. IRS managers are able to make strategic decisions on the use of resources based on coverage levels.
    - Although mSpray has the potential to provide information on the number of structures found, the estimated surface area eligible to be sprayed, and the location of each structure, the real-time benefit of this was not realized because the data entered on the tablets could not be transferred to the central data server immediately.
    - mSpray is capable of identifying IRS target areas using a quantifiable, scientific approach utilizing a range of variables (e.g., malaria incidence, environmental factors, population density, etc.). This process is systematic, structured and reproducible.
    - mSpray used the Google Maps GPS function to accurately pinpoint location.

7.3.1.2 Challenges

- GPS coordinates were not collected in some areas due to a poor GPS signal.
- Some TLs were entering the wrong target area; hence data was not updated on mSpray.
- In some districts maps were loaded onto tablets for the specific catchment areas that were to be visited for a particular day. If spray operators completed spraying in that particular catchment area they could not continue with the next catchment area because the required maps would not have been loaded.

- During the initial phase of spraying, coordination of spray teams by Akros supervisors was not particularly well managed.
- There was high discrepancy between IRS program data and data reported through mSpray. This is because it took long before data from mSpray could be updated. This defeated the whole added benefit of having real time data to inform decision-making.
- Updates on the mSpray maps were not completed on time; they occurred mainly in the two mSpray districts that started spraying first and they lasted for about 3-4 days. Some of the updates were done as late as three weeks after the data had been captured. Some examples of the challenges are: demolished houses were not taken out of target during the spray; some non-eligible structures captured during mSpray mapping were not taken out of the spray targets even when classified as not eligible; sprayed structures appearing as not visited in the mSpray platform; visited and unsprayed structure still appeared as not visited in mSpray platform; newly added structures that were sprayed still appeared in the mSpray platform as an eligible structure not visited, even after being added.
- There was lack of effective supervision from team leaders due to a lot of their time being spent on data collection and tablets rather than spray quality checks.

7.4 Data Quality Assurance and Control

During the 2015 spray season, AIRS Zambia used the AIRS M&E Supervisory Toolkit, which consists of the following two tools to standardize and improve data collection:

- Error Eliminator (EE) forms to verify the completeness and correctness of spray data collected in the field. The EE facilitates a systematic review of the SOP forms and easily exposes common errors for correction by supervisors at various levels. During the spray campaign, the EE was completed daily by team leaders for 100% of their SOPs, and randomly by IRS managers, supervisors, district coordinators as well as AIRS senior staff visiting the districts.
- Data Collection Verification (DCV) forms used for checking the accuracy of data collected in the field. M&E assistants and supervisors used the DCV form to ensure that the data recorded on the Daily Spray Operator Forms matched the information reported by households.

7.4.1 Physical Data Verification

Physical data verification was performed at three different levels:

- Team Leader Level: 100% of spray data collected on SOP forms were reviewed and arithmetically verified.
- District Level: each supervisor had to meet a target of reviewing 5 sprayed structures per week in their district while district coordinators had to meet a target of reviewing 20 sprayed structures in their districts respectively.
- Staff from the AIRS and NMCC central level did perform random data verification as part of routine monitoring visits across the 39 target districts.
- Data Entry Level: Data clerks reviewed each form for typos and transcription errors, and verified the arithmetic before entering the data into the database.

7.4.2 Database Quality Control

AIRS Zambia used the Access database programmed audit checks and data locks to reduce the number of data entry errors. AIRS Zambia also used the IRS Reporter (cleaning/reporting) tool to help data clerks clean and reconcile data. Additionally, AIRS Zambia required DECs to enter data in two ways: 1) by spray "Totals" or a summary of each Daily SOP Form in order to produce "real-time" reporting of spray progress, and 2) by spray "Details" data (line-by-line or structure-by-structure) for more accurate data entry and high quality data. During data cleaning via the IRS Reporter, DECs investigated and reconciled discrepancies between spray "Totals" and "Details" data for a final dataset reporting campaign results. Corrections were made to the paper spray forms and the database, where necessary.

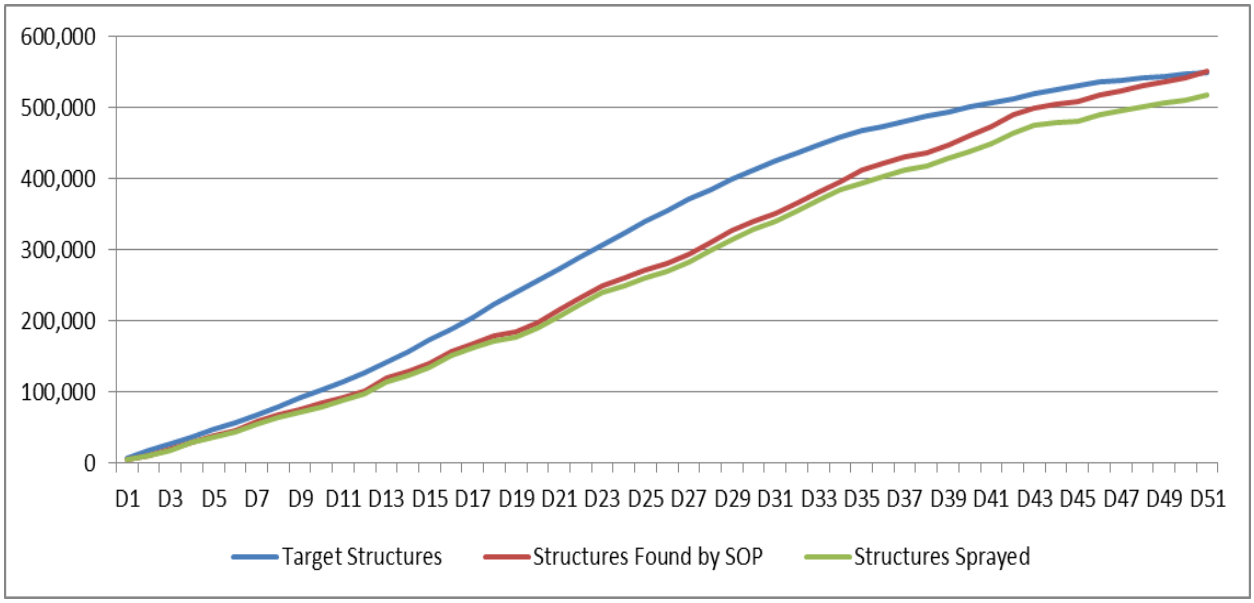
7.4.3 Random Spot Checks

The M&E team performed daily data verification activities of the Access database to guarantee the quality of the data. They scanned the database and ran spray progress reports to identify progress and anomalies in data entry. In the event they found discrepancies between data collected and data entered that could not be reconciled at the data center, the M&E team contacted the field supervisor for clarification to resolve the issue.

M&E assistants conducted field checks by visiting villages previously sprayed a few days prior to randomly interview households on their spray status. They collected these data using the DCV form and compared them with data collected on the SOP forms. Any discrepancies were addressed and rectified with the appropriate AIRS staff.

7.5 IRS Results

FIGURE 4: IRS DAILY PERFORMANCE TRACKER



7.5.1 Insecticide Usage

The total number of bottles used during the 2015 campaign was 137,008. On average, one bottle sprayed 4.0 structures (see Table 11). The average number of bottles used by a spray operator per day was 4.0, and each operator, on average, sprayed 14.7 structures per day in the 39 target districts.

TABLE 11: INSECTICIDE USAGE

Please see the M&E Plan Matrix in Annex 10 for a full list of project indicator targets and results.

Province	District	Structures Sprayed	Bottles Used	Avg Sprayed Structures per Bottle	Avg Bottles per SOP per Day	Structures Sprayed per Day per SOP
Eastern	Chadiza	12,777	2,830	4.5	3.1	14.3
	Chipata	52,930	12,088	4.4	4.7	19.8
	Katete	22,755	6,419	3.5	4.3	15.4
	Lundazi	26,714	7,008	3.8	4.7	17.4
	Mambwe	7,479	1,594	4.7	4.6	20.2
	Nyimba	13,829	2,473	5.6	2.8	15.4
	Petauke	31,526	9,121	3.5	4.4	15.3
	Sinda	6,598	2,216	3.0	5.1	15.2
	Vubwi	5,282	1,599	3.3	5.0	15.8
Muchinga	Chama	15,966	2,318	6.9	2.2	15.1
	Chinsali	8,463	2,144	3.9	4.7	18.6
	Isoka	5,799	1,796	3.2	4.2	13.7
	Mafinga	5,716	1,200	4.8	3.1	14.7
	Mpika	11,707	3,271	3.6	4.2	15.0
	Nakonde	12,640	3,660	3.5	3.9	13.3
	Shiwang'andu	4,280	1,305	3.3	4.0	13.6
Northern	Chilubi	14,038	1,972	7.4	5.2	15.6
	Kaputa	10,642	3,147	3.3	3.9	14.4
	Kasama	22,574	6,109	3.7	3.3	9.4
	Luwingu	15,180	5,280	2.9	4.3	12.7
	Mbala	12,620	3,720	3.4	3.9	13.5
	Mporokoso	10,894	2,603	4.4	3.5	14.3
	Mpulungu	8,921	3,345	2.7	5.7	14.3
	Mungwi	10,967	5,340	2.1	5.3	20.2
	Nsama	7,959	2,402	3.3	4.2	13.3
Luapula	Chembe	4,940	1,209	4.1	3.0	12.2
	Chienge	24,374	6,786	3.6	3.2	11.7
	Chipili	1,522	276	5.5	2.8	15.2
	Kawambwa	11,297	3,794	3.0	3.6	11.7
	Mansa	22,604	6,285	3.6	4.2	14.7
	Milenge	1,842	582	3.2	3.1	7.7
	Mwansabombwe	7,111	1,647	4.3	3.0	13.0
	Mwense	18,136	6,167	2.9	4.4	13.7
	Nchelenge	24,219	5,103	4.7	3.2	14.6
	Samfya	29,984	6,855	4.4	3.4	15.6

Central	Chitambo	1,887	507	3.7	4.2	15.7
	Luano	970	179	5.4	2.9	15.6
	Mkushi	8,530	1,758	4.9	3.0	15.3
	Serenje	3,926	900	4.4	3.3	14.5
Total		**519,598**	**137,008**	4.0	3.9	14.7

8. ENVIRONMENTAL COMPLIANCE

This chapter focuses on the activities that were undertaken in overseeing IRS program compliance with:

- The United States Government (USG): USAID Regulation 216,
- The Government of the Republic of Zambia Environmental Regulations: Zambia Environmental Management Act cap 204, No 12 of 2011, and
- The 2015 Supplemental Environmental Assessments and Pesticide Evaluation Report and Safer Use Action Plan (PERSUAP).

Prior to the launch of the 2015 Spray campaign on September 28, the Environmental Compliance team was principally responsible for conducting environmental compliance assessments and inspections (PSECA) to ensure that all the IRS operations sites in all the 39 districts met the minimum requirements for environmental compliance and safety. Mid spray environmental compliance inspections were also conducted during IRS implementation to ensure that all operational related activities were conducted in a safe and environmentally sound manner through a holistic strategic approach, with no adverse impacts on the community, SOPs and the environment at large. Post-spray activities with regard to site cleanups (decommissioning) and waste disposal procedures were implemented right after IRS implementation and these activities were conducted in accordance with the PMI BMP as mandated by the Environmental Mitigation and Monitoring Plan (EMMP). The chapter also contains some of the outstanding issues that came up during IRS implementation and more details can be found in Annex 11 – the Environmental Mitigation and Monitoring Report (EMMR).

8.1 ENVIRONMENTAL DOCUMENTATION CHANGES

It is a requirement by USAID that an annual letter report is submitted to PMI which must contain information regarding program changes with regard to environmental compliance such as new spray areas or insecticide and selection of new operations sites. It should also contain results of environmental monitoring and how the program will improve areas of deficiency. Submission of an SEA or SEA amendment preempts the need for a letter report in the year the SEA was approved. A new SEA to cover IRS activities in Zambia from 2015 to 2020 was prepared and approved prior to the commencement of 2015 spray operations.

8.1.1 SUPPLEMENTAL ENVIRONMENTAL (SEA) AMENDMENTS

A nationwide environmental assessment was conducted in June 2015 in order to prepare an SEA for Indoor Residual Spraying (IRS) in Zambia for the period 2015-2020. Previous environmental documentation for PMI-supported IRS in Zambia authorized the use of the pyrethroid, carbamate and organophosphate classes of the WHOPES-recommended pesticides in the high malaria burden regions of Zambia from 2010-15, and was prepared in accordance with the provisions of USAID 22 CFR (216) regarding the use and application of pesticides. The current SEA is nationwide in scope and reauthorizes the use of the same 3 classes of WHOPES-recommended insecticides, authorizes the use of dichlorodiphenyltrichloroethane (DDT), and expands the authorization to include the use of chlorfenapyr (when recommended by WHOPES). The SEA was approved in September prior to the launch of the 2015 IRS campaign.

8.2 PRE-SEASON ENVIRONMENTAL COMPLIANCE ASSESSMENT (PSECA)

In preparation for the 2015 spray season, the in-country EC team and MOH district representatives worked together to identify facilities for the storage of pesticides, PPE, and other IRS commodities. The storage facilities that were not in good shape and failed to meet PMI BMP guidelines were rehabilitated in order to make them suitable for the storage of IRS commodities. In April 2015, the ECO travelled to all the district IRS operations sites in order to ascertain the district preparedness with regard to the state of the IRS facilities such as warehouses, soak pits, shower rooms, pit latrines, wash bays etc. During the period under review the Pre-Season Environmental Compliance Assessment (PSECA) tool imbedded on EC Smart Phones was used in order to assess among other things:

- The siting, construction, and security of the soak pits used to capture rinse water during the end of day cleanup.
- Warehouse capacity to store and handle pesticides and other IRS supplies.

These assessments were conducted in accordance with U.S. and the Zambia environmental regulations as well as supplemental guidance from Food and Agriculture Organization (FAO) standards. Subsequently, work lists detailing environmental compliance deficiencies at each IRS operations site was generated and, based on the assessment findings, an implementation plan was prepared to address all deficiencies.

The roles and responsibility of respective individuals from both AIRS and MOH were delineated in the implementation plan that was developed to address EC deficiencies. The refurbishment process commenced after the plan was approved and the method employed included the following:

- Generation of Bill of Quantities (BOQ) by the ECO and MOH district representatives
- Tendering process exclusively conducted by AIRS procurement office
- Submission of quotations from the respective districts
- Analysis and consolidation of BOQs and quotations
- Awarding of contracts to potential vendors
- Commencement of IRS facility refurbishments

In order to adequately prepare for the 2015 IRS campaign and meet the minimum EC requirements stipulated in PMI BMP, 13 new soak pits were constructed and ten existing ones that were not in good condition were renovated. Since the number of SOPs in some of the districts increased drastically, wash bays had to be expanded at some operations sites to avoid congestion at the soak pit during end of day cleanup. In some districts, the distance between the primary soak pit and the spray site was too long, and as such the use of mobile soak pits (MSP) was encouraged in those areas. A total of 65 MSP were constructed in order to facilitate end of day cleanup at the distant spray areas, using a 4-rinse barrel triple rinsing technique.

8.2.1 NEW SPRAY AREAS/ OPERATIONAL SITES/ MAJOR RENOVATIONS

Most of the districts in Northern Province are so huge that SOPs in the previous years had to cover long distances to reach the spray sites and at times they could report back at the operations site past 6pm which led to increased EC concerns during end of day cleanup. Therefore, in 2015 all the huge districts were subdivided into different divisions and at each subdivision an IRS operations site was set up. In total twelve new operations sites were created and therefore IRS facilities, such as warehouse, soak pit, shower/change rooms, pit latrines, and wash bays were thus established in Kaputa, Shiwang'andu, Milenge, Kawambwa, Mporokoso, Mambwe, Chiengi, Chama and Chilubi districts. Apart

from the aforementioned IRS operations site establishments other major renovations involved were: renovation of storage facilities in Kasama, Petauke, Nakonde, Samfya, Chiengi, Nyimba, Mpika and Chembe; construction and fencing of new soak pits in Chipili, Samfya and Chipata; construction of a pit latrine, bath and changing rooms in Chadiza, Vubwi, Mwense, Luwingu, Mungwi, Katete and Mpulungu; as well as installation of water distribution systems in Mbala, Kasama and Mpulungu. In all cases, the work was done by different vendors under the full supervision of the DCs, MOH district representatives and final approval by the in-country ECO.

8.2.2 Pre-season Environmental Compliance Inspections

After having successfully addressed all the EC deficiencies identified by PSECAs, two weeks prior to the launch of the spray campaign, the EC team revisited all IRS bases to confirm that the refurbishment processes were conducted according to the plan and ascertain the district's preparedness for the 2015 IRS campaign. During the period under review, all the storage facilities in all PMI supported districts met the minimum EC requirements and were certified ready to receive and safely store pesticides. Additionally, all soak pits were suitable for an environmentally responsible disposal of pesticide-contaminated liquid waste, except for the one in Nchelenge which clogged on the second day of IRS operations because its top layer (gravel) contained some soil particles. This problem was however rectified and the soak pit began working properly as a filter.

8.2.3 Pre-contract Motor Vehicle Inspections

In September, prior to the awarding of contracts to the transport vendors, all vehicles were subjected to an inspection against PMI BMP to ensure compliance with safety and environmental requirements. A total of 67 vehicles (trucks) were hired through this process and consequently, 83 drivers were trained in the drivers' trainings that were conducted in Lusaka, Mansa, Kasama and Chipata few weeks before the commencement of the spray campaign. During the inspection, transporters were advised to retrofit the trucks with benches, tents, railings and to ensure that all the trucks were roadworthy; which advice was followed. All the vehicles hired were equipped with Spill Management and First Aid kits, Material Safety Data Sheets and Accident/Emergency response procedures. One of the challenges faced during pre-contract motor vehicle inspection was that some of the vehicles didn't meet the standards and therefore were rejected. So it took long for some vendors to replace them.

8.3 Medical Clearances

All the SOPs that were engaged to take part in the 2015 spray season underwent medical examinations and only the SOPs who passed the examinations were incorporated into the program. Additionally, all female SOPs were provided with pregnancy testing before the commencement of the IRS campaign. The test was repeated on the 30th spray day for the districts that had a spray calendar of more than 30 days. The medical tests conducted included: pregnancy test (for females), physical examination, hemoglobin (Hb) and blood pressure.

In the course of IRS operations and in order to ensure that SOPs' safety was upheld, the ECO carried out random physical inspections during morning mobilization to check for any SOPs who might have been experiencing difficulties in breathing, fatigue, weakness, and alcohol intoxication etc. In addition, spray team leaders and supervisors were trained to monitor their operators for any of these signs of problems.

8.4 Management of Insecticide Adverse Effects

Due to the fact that organophosphates used in the 2015 spraying season are toxic for humans and to the environment if not handled according to specifications, a two-day training was conducted in order to orient clinicians from all PMI supported districts with regard to the possible toxic effects of insecticides and their management. The trainings were conducted in Mpika, Mansa and Petauke districts, with the

objective to strengthen the skills of clinicians in the diagnosis and treatment of pesticide poisoning in case of an occurrence of such unforeseen incidences during IRS operations. The topics covered in the training included: mechanism of action, clinical presentation, and diagnosis and treatment of pesticide poisoning. The training focused on specific WHOPES recommended pesticides, namely organophosphates, as well as carbamates, pyrethroids and organochlorines.

A total of 77 participants attended the training from 39 districts in the DFID and PMI supported provinces. The participants' knowledge was assessed before and after the course. The average score in the pre-course test was 54% with minimum and maximum scores of 24% and 85%, respectively. The post-course test scores improved to an average score of 85% with the lowest and highest scores of 42% and 90%, respectively.

In readiness for any unforeseen incidences such as insecticide poisoning, atropine which is an antidote for insecticide poisoning, was readily available in all district hospitals as well as central medical stores. The GRZ through the MOH plays a pivotal role in supplying the hospitals and clinics with atropine which is advantageous to the IRS program in Zambia due to the fact that all IRS operations sites are located on the district hospital grounds which renders the distance between the IRS base and the nearest health facility negligible.

8.5 Mid-spray Environmental Compliance Inspections

The 2015 IRS monitoring and supervision was conducted by all AIRS staff in close collaboration with the MOH employees in the respective districts using EC tools embedded on smart phones. A total of 95 smart phones were procured in order to enable the electronic submission of all mid spray inspection reports. Other MOH employees, mostly EHTs who took part in IRS implementation as supervisors but were not accorded an opportunity to have a smart phone, were encouraged to use paper based monitoring and supervisory checklists when administering mid spray inspections. The paper based reports were reviewed by the ECO and the DCs once every week. During the spray season four inspections were conducted on each spray day and these included the following:

8.5.1 Morning Mobilization and Transport Inspections

This inspection was performed in the morning before deployment of SOPs to their respective spray sites in order to ensure that:

- All inventory safeguards and documentation requirements were adhered to
- SOPs had a meal prior to donning PPE
- Adequate PPE was provided to the SOPs prior to their deployment
- SOPs were not overcrowded in the vehicles
- SOPs' transport vehicles were roadworthy with adequate EC items such as fire, extinguisher, spill kit, a first aid box as well as spill and emergency response procedures

All SOPs, washers, drivers, storekeepers and supervisors were each assigned adequate PPE which included coveralls, gloves, boots, helmets, face shields, and nose masks for use throughout the spray period. All spray teams in all the 39 districts began their operations with a morning meal and later donned their PPE in readiness for deployment.

Transportation of SOPs and insecticides from the operations sites to the spray sites was done using trucks that were retrofitted with benches, tents and railings. Before transport contracts were awarded to the potential vendors a meeting was convened to discuss the EC requirements with regard to the

nature of vehicles to be hired, and therefore all the vendors adhered to the guidelines that are stipulated in the PMI BMP.

During morning mobilization, most of the activities in most of the districts were conducted in accordance with the BMP guidelines except a few lapses indicated below that were noticed in the first few days of IRS operations:

- Some team leaders in some districts were not conducting casual physical inspections of SOPs until they were reminded to do so.
- Not all pesticide and contaminated rinse water was used up to fill SOPs' tanks when going for operations in first two days, which could have led to cake formation if the AIRS team had not intervened

All the above highlighted issues were carefully and safely handled by the AIRS staff that had spread out in all the 39 districts for monitoring and supervisions in order to ensure that PMI BMPs were adhered to. Every time, especially in the first few days, an anomaly was reported, corrective measures were put in place and subsequently, a meeting was convened with the spray teams and guidance was given on the way forward regarding the best practices in order to avoid repetition of same EC violations.

8.5.2 Home Owner Preparations and SOP Performance Inspections

The main aim of this inspection was to ensure that Spray Operators were spraying houses (structures) that had been correctly prepared for spraying (inside and out) and that SOPs were using correct spraying and insecticide handling techniques.

These inspections were performed while SOPs were in the field conducting IRS. The AIRS and MOH teams conducted these inspections to ensure that SOPs and homeowners followed prescribed procedures outlined in the PMI BMP. During this inspection, AIRS EC team, DCs and MOH district representatives inspected the following:

- House preparation,
- Use of PPE during spraying,
- Mixing of chemicals,
- Field triple rinsing of bottles
- SOP performance,

These inspections also involved interviewing homeowners to assess whether they were furnished with adequate information on post spray activities during community mobilization by mobilizers and/or during spraying by SOPs. The SOPs conducted their operations by applying the knowledge they acquired during cascade training by adhering to the following steps:

- Mixing of pesticides in presence of home owners
- Triple rinsing of empty pesticide bottles while in the field
- Adequately informing home owners about pre, during and post spray activities.

However, in as much as almost all the activities were undertaken in accordance with what is described in the SOPs manual, there were few lapses that were reported in the first few days of IRS operations and this could be attributed to the fact that SOPs were still getting used to the spraying techniques. . Below are some of the few irregularities that were reported:

- A few residents were refusing IRS because of the following:

    - Residents claimed they were not fully informed about IRS,
    - Resident claimed not all mosquitoes died after the last spray season
    - Residents were not satisfied with the last spray campaign
- Some SOPs were not spraying all the recommended surfaces
- Some SOPs were not spraying at the correct speed and could not maintain the swath
- In the early days of operations, some residents did not confine animals during and after spraying, until the SOPs were reminded not to administer IRS if animals were not confined.

All the above reported non-compliant issues only occurred in the initial stages of IRS implementation and corrective measures were immediately instituted, which subsequently resulted in a drastic reduction in the number of non-compliant issues. In order to ensure that homeowners were left with adequate information regarding post spray protocols and requirements, community mobilizers were encouraged to go back to the areas which they had earlier mobilized in order to remind homeowners that the spray team would be in their area on the following day. As such homeowners were left with adequate information on what they must do before, during and after IRS implementation.

8.5.1 Storekeeper Performance Inspections

The main objective of this inspection was to ensure that Storekeepers were following best warehousing practices and accounting for all IRS commodities and equipment in stock. The fact that most of the store keepers were new in the program made it a bit difficult for them to do their work as required in the first few days of operations. However, since all AIRS employees were also in the field to monitor operations, a number of non-compliant issues that were spotted were rectified immediately and correctives measures were implemented. As such, there were no critical recurring non-compliant issues except a few lapses indicated below that were reported:

- Missing items in the First Aid boxes such as eyewash, antibiotic, band aids gauze etc. This could be attributed to the fact that most of our IRS bases are located at the hospital or health center premises and such items are readily available in the hospitals and are normally in the custody of a clinician who underwent poison management training.
- In some districts there was deficient record-keeping: poor filing system which led to a number of discrepancies in stock management. However, such incidences only occurred in the first instances and were rectified by conducting a physical count of all the stocks until reconciliation between empty bottles and full stocks was reached.

As the program reached its climax all the storekeepers improved their performance and in the end everything was normalized and there was literally little or no non-compliant issues recorded.

8.5.2 End-of-day Cleanup Inspections

The main aim of this inspection was to ensure that the spray teams followed the correct EC procedures for cleaning equipment, disposing of leftover pesticides and rinse water from cleaning PPE and pumps, accounting for insecticide stock, and safe storage of equipment for use the following day.

The end of day cleanup inspection was conducted at the IRS operations site and the camping sites where mobile soak pits where in use at the end of the day after SOPs had returned from the field. The EC team, DCs and MOH district representatives carried out site inspections to ensure that cleanup and waste disposal procedures as mandated by the EMMP were followed. During this inspection, AIRS staff closely monitored the use of the seven rinse barrels during triple rinsing and made sure all effluent from rinsing PPE drained into the soak pits. The inspections also ensured that rinse barrels were covered overnight, and soak pits together with wash bays were nicely fenced, gated and locked to prevent unauthorized entry into the premises.

During the 2015 IRS campaign there was a drastic reduction with regard to non-compliant issues during end of day cleanups as compared to the 2014 spray campaign, due to the fact that a new cadre, called a washer, was introduced in the program at all the districts to do laundry for the SOPs and prepare their PPE for the following day's use. This move was excellent as it completely prevented SOPs from carrying PPE to their respective homes.

Furthermore, not only did SOPs at a minimum wash their faces and hands after spraying but they were also prompted to shower on-site because all the IRS facilities were equipped with shower and change rooms with adequate water and privacy.

The few non-compliant issues that were reported in the first few days of IRS operations included the following:

- Rinse and/or waste water drums were left uncovered overnight
- Team Leaders were not supervising cleaning and wash-up which could have led to triple-rinse violations had it not been for the presence of AIRS employees
- Some supervisors in some districts were not checking the spray operator forms after the spray day. This was also prevented from continuing by the presence of AIRS staff who put up corrective measures
- Some SOPs did not continue to wear PPE on the way back to the operations site.

The presence of AIRS operations Staff and ECO played a pivotal role in rectifying the non-compliant issues encountered during operations thereby administering the four cardinal monitoring and supervisory checklists and above all, the ECO provided regular supervision and oversight of the campaign, specifically:

- Close monitoring of the use of PPE by spray operators and supervisors,
- The insecticide tracking system,
- Safety precautions followed by the spray operators in spraying houses to prevent residents' and environmental exposure to insecticides,
- Store management procedures
- Precautions followed around operations sites to prevent contamination of the environment. and
- Daily SOP motor vehicle transport inspections.

8.6 INCIDENTS

During the 2015 spray campaign, there were no major incidents that occurred, except the minor unforeseen occurrences that were encountered in Nchelenge, Nyimba, Vubwi, Katete and Mwansabombwe. All the incidents were recorded and reported immediately.

In the first two days of operations in Nchelenge, the soak pit clogged due to the fact that the top layer (gravel) of the soak pit contents contained soil particles which reduced the rate of rinse water percolation into the soak pit. The challenge was immediately resolved by using adequate gravel like the one used in road construction, whereupon the soak pit began acting like a filter.

In Nyimba, as a washer was doing laundry, she accidentally hit the rinse barrel that contained rinse water from the spray pumps and the rinse water spilt on the bare ground surrounding the wash area. In Katete, during end of day clean ups, the first barrel used for receiving leftover pesticides from the field during triple rinsing was placed too close to the edge of the wash area resulting in SOPs spilling pesticides from the spray tank when empting into the drum onto the bare ground surrounding the wash area.

However, in both the Katete and Nyimba incidents, the spillages were not significant and only traces of the spill could be spotted on the edge of the wash bays and the ground surrounding the wash area. The affected soil was scooped and was kept at the storage facilities awaiting an environmentally sound disposal. As a corrective measure all the rinse barrels in all the districts were then lined up in the middle of the wash bay to avoid repetition of incidences of such nature.

In Vubwi, there was a suspected food poisoning incident which occurred when SOPs were having a morning meal before their deployment into the field. SOPs that ate vegetables (rape) which were suspected to have contained an unknown insecticide used in agriculture. The SOPs complained of abdominal upsets, epigastric pain and loose stool. All the affected SOPs were put on treatment and IRS in this district was suspended until all the SOPs were fit to do the work. A thorough investigation by MOH through the Public Health Office (PHO) was conducted and a report was submitted immediately.

Finally, an SOP in Mwansambombwe died during the period of spraying. The death, however, was not linked to exposure to pesticides but the suspected cause of death was acute renal failure due to an infection as reported by the clinician in the file and on the death certificate. The clinician did not find any evidence of organophosphates poisoning.

8.7 POST-SEASON ENVIRONMENTAL ASSESSMENT

The AIRS Logistics Officer, DCs and ECO in collaboration with the district representatives from MOH set out to conduct post spray inventory and audits of all IRS commodities immediately after the spray campaign came to an end. The outcome of this exercise would serve as a bench mark in planning for the 2016 spray season. All the IRS commodities including the chemical balance in stock will be safely stored in the district storage facilities for use in the next spray season.

8.7.1 CLOSURE OF STORE ROOMS AND SOAK PITS

Decommissioning of all IRS facilities, specifically store rooms and soak pits, was principally the role of the ECO supported by the MOH personnel from the respective districts through an activity known as *Post IRS Environmental Compliance (EC) Inspection*. Post Spray Environmental Compliance Inspections are conducted by the ECO in order to ensure that all the IRS operations sites are decommissioned and preserved for the next spray season. These inspections give guidelines on the decommissioning procedures that have to be undertaken immediately after the IRS campaign. The primary focus was to safeguard all IRS commodities and ensure that they were left clean without any traces of chemical which might be of danger to both human beings and the environment. During the inspection, the ECO made sure that the following was undertaken:

IRS Documentation:

- All the records for all IRS commodities were updated and balanced up.
- The amount of chemical used tallied with the empty bottles available
- Submission of Medical Examination records for record keeping at central level
- Submission of Certificate of completion regarding EC rehabilitation works for record keeping

Pesticide Storage facility: The storage facilities were thoroughly washed with soap and water. The chemical stock in balance together with other IRS commodities as well as IRS wastes were clearly quantified, labeled and nicely packed. EC items such as pallets, hand washing bucket, fire extinguisher, thermometer, first-aid kit, spill management kit, emergency and spill response procedure as well as waste storage bins have been preserved for use in the 2016 IRS campaign. All IRS wastes are temporarily kept in the storehouses awaiting a safe and environmentally sound disposal in presence of representatives from ZEMA and MOH.

Soak Pit and Wash bay: The wash bays were washed with adequate water in order to remove all traces of pesticides and all the waste water drained into the soak pit. The soak pits have since been covered in order to prevent fallen material e.g. debris to get to the soak pit during the off season as they have potential to affect the functionality of the soak pit. The Soak pit area has been locked with danger signs displayed in order to avoid unauthorized access to the facility. The fact that the off spray season normally falls in rainy season a lot of vegetation (grass) during this period grows taller therefore, the ECO has instructed the DCs to be conducting periodical grass cutting at specified time intervals (two to three weeks).

Personal Protective Equipment (PPE): Overalls, helmets, face shields and gum boots were thoroughly washed with soap and water and kept safely in the store room for use in the 2016 spray campaign.

Defective Pumps: Defective spray pumps and other IRS equipment that got damaged during the IRS implementation have safely been stored in the district store rooms and will be repaired before the commencement of the 2016 spray season.

IRS Waste: Used nose masks, polythene sheets and worn out coveralls, face shield, helmets, gloves, boots, and back packs (bags) were quantified, weighed and kept in respective waste bins awaiting the environmentally sound disposal.

8.8 IRS WASTE DISPOSAL

Anything that was discarded during the implementation process was regarded as IRS waste. The waste material generated from IRS operations was usually in two categories: i.e., liquid and solid waste. IRS solid waste was further categorized into four groups: paper, plastic, rubber, and cloth. The table below shows categories of IRS solid waste generated in the 2015 campaign.

TABLE 12: CATEGORIES OF IRS SOLID WASTE

Plastic	Cloth	Rubber	Paper
Empty Bottles	Used Nose Masks	Gum Boots	Empty Actellic Boxes
Polythene sheets	Cloth	PVC Gloves & Boots	Nose Mask Packages
Helmet & Face shields	Worn out Overalls		

Liquid Waste: Liquid effluent from the rinsing of pumps was reused as water for mixing chemicals on the following day and the wash water from washing the outside of the spray tank and rinsing of the strainer and nozzles was drained into soak pits that are carefully sited according to the criteria in the PMI BMP manual. The soak pits were designed so that traces of pesticides in rinse water could be adsorbed by the charcoal layer, and held until environmental processes result in the degradation of the pesticide.

Solid Waste: At the end of the spray season, non-pesticides contaminated wastes, or those that were cleaned thoroughly with soap and water were nicely labeled and kept in the storage facility awaiting a safe and an environmentally sound disposal method. These types of waste include; worn out overalls, gum boots, gloves as well as used mutton cloth and polythene sheet. These items will be distributed to spray operators once a distribution plan is finalized.

Solid Waste Disposal Streams: Below are the disposal methods for each type of waste which was generated in the 2015 Zambia IRS campaign:

Insecticide Containers: By February, 2016 all the empty bottles together with carton boxes will be collected from the districts and taken to central level at Lusaka Cleansing Depot awaiting thorough cleaning with soap and water, removal of labels and seals, compression and bailing prior to their shipment to the Republic of South Africa (RSA) for recycling. Bottles from the 2013 and 2014 spray campaigns have been collected from all the districts and are stored in the ware house in Lusaka pending compression and bailing.

Cardboard Boxes: Incineration of cardboard boxes may add considerably to the cost and workload of incineration. Cardboard boxes may also generate large amounts of carbon dioxide and other air contaminants. In order to avoid such issues, uncontaminated boxes will be supplied to Zambezi Paper Mills (ZPM) as raw material in the manufacturing of carton boxes, books, pencil etc. Contaminated cardboard boxes on the other hand (i.e., cardboard boxes that contained insecticides with damaged packaging) will be incinerated with nose masks at ZEMA approved provincial medical hospital incinerators and/ or the University Teaching Hospital incinerator.

Gloves and Boots: Due to the fact that the gloves and boots used in IRS contain greater than 1% chlorine, these will not be incinerated because they can create dangerous Persistent Organic Pollutants (POPs) in contravention of international agreements. Therefore gloves and boots which would no longer be used in future IRS campaigns were thoroughly washed with adequate soap and water after the spray campaign and will be donated to SOPs for their personal use.

Dust Masks, Overalls, and Back Sacks: Waste dust masks are always considered as contaminated and hazardous and will therefore be incinerated at ZEMA approved provincial hospitals or UTH incinerators. Overalls and back sacks that would no longer be used for IRS will be given to SOPs for their personal use, after they are thorough washed with adequate soap and water. Table 7.2 below shows the summary of type, quantity and disposal stream of the 2015 IRS solid waste.

TABLE 13: SUMMARY OF TYPE, QUANTITY AND DISPOSAL STREAM OF THE 2015 IRS SOLID WASTE

S#	Waste Category	Qnty (Kg)	Disposal Stream
1	**Plastic**		
	Empty Bottles	Physical Count 137,008	Shipping to RSA for recycling after thorough cleaning, removal of labels, compression and baling
	Plastic Sheeting	359.6	Disposal at provincial municipal dumpsites after thorough cleaning with soap & water
	Helmet & Face Shields	344.6	Disposal at provincial municipal dumpsites after thorough cleaning with soap & water
2	Rubber		
	Boots	182	Worn out boots will be given to deserving SOPs after been thoroughly cleaned with soap & water
	PVC Gloves	276.5	Gloves will be disposed of at designated dump sites after cleaning with soap and water
3	**Clothing Material**		
	Used Nose Masks	673.8	Masks were weighed at the point of generation and will be incinerated at UTH or the ZEMA approved provincial hospital incinerators

	Mutton Cloth	305	To be given to each and every SOP for their personal use after washing with soap & water
	Worn out Overalls and Back Packs	689	Overalls and Bags will be given to deserving SOPs after been thoroughly cleaned with soap & water
4	**Paper**		
	Empty Carton Boxes		Contaminated boxes will be incinerated whereas uncontaminated boxes will be supplied to Zambezi Paper Mills (ZPM) as raw material

9. Capacity Building

One of AIRS Zambia's main tasks is to enhance government staff's technical knowledge and management capacity to implement IRS. AIRS' guiding partnership principles emphasize the importance of building relationships with local partners and strengthening their skills in areas such as strategic planning, leadership, operating systems (technical) advocacy, organizational management and project development and management.

Zambia was selected to receive the Encompass training in 2015 since the country has extensive government involvement in the implementation of IRS. The training occurred from June 29 - July 6 and 89 participants attended including 40 IRS Managers, ten Master Trainers, 18 AIRS DCs, ten AIRS Zambia staff from the Lusaka office, six NMCP staff and five Provincial Environmental Health Officers. This workshop is designed to strengthen project managers' ability to implement, supervise, and evaluate indoor residual spraying (IRS) operations at the district and provincial levels. The workshop was divided in to three components. The first component was designed to build capacity for project managers at district and provincial levels. The training was developed to provide a detailed overview of IRS to AIRS staff and MOH partners at the district and provincial levels. The second component was designed for facilitators and trainers of IRS. This workshop was developed to increase the effectiveness of IRS trainings by educating IRS staff facilitators on adult learning techniques and current best practices. Additionally, this training encouraged participants to examine the trainings they conduct most often and create plans to conduct a needs assessment, improve training delivery (including interactive methods and participatory approaches), and consider plans for evaluation. The last one was designed for leaders at the national level. This national-level workshop was designed to increase engagement of national stakeholders in IRS. The approach used was a mix of an overview of IRS planning and processes, with discussion of influence approaches and how to involve other key stakeholders in the process. This training was designed to be largely discussion-based and focused on creating plans to provide support for IRS.

Overall, the training provided IRS managers with the skills and knowledge to perform the following:

- Outline the steps to prepare for an IRS campaign
- Describe best practices in community spray operations
- Evaluate IRS warehouse and storeroom management, ensuring adherence to minimum standards
- Assess IRS environmental compliance using a standardized checklist and recommend improvements for any activities that do not meet the standard
- Guide community mobilizers and community leaders to effectively deliver key messages for IRS
- Use IRS data to effectively monitor the program and make informed decisions
- Train seasonal workers using participatory methods and interactive facilitation techniques

The majority of the participants who were trained got involved during the 2015 spray and used the skills and knowledge that was gained from this training.

In entomology, AIRS conducted a series of in-class and practical workshops to prepare cadres of district-level environmental health officers and human landing collectors to manage entomological data collection at the sentinel sites. In addition, the AIRS Benin Technical Manager traveled from Benin in February to train the insectary technicians, three environmental health officers and the entomological coordinator on the identification of adult *Anopheles* mosquitoes to species using the Gilles & Coetzee 1987 identification key, as well as ovary dissection for parity determination.

As part of capacity building, in the 2015 work plan, AIRS Zambia provided financial support for a NMCP IRS technical working group (TWG). The main aim of the the TWG is to make sure that the program has efficient technical policies, procedures, and standards as required to ensure correct application of IRS and sustainability of IRS. Also as part of the capacity building, AIRS Zambia organized a post-spray meeting with NMCP during 2015 to discuss the 2015 campaign and the plan for the 2016 campaign. In January 2016, a post-spray meeting was held in Kitwe where successes and challenges for IRS in the PMI and PATH supported provinces were discussed.

In 2015, it was also planned that AIRS Zambia will determine the details of the capacity building plan which will be developed in collaboration with the MOH and PMI. Unfortunately, these were not done because of competing activities and stakeholders did not have enough time to analyze and prioritize capacity building activities. This has been proposed in the 2016 work plan.

10. ENTOMOLOGY

Entomological surveillance is an important activity in malaria control because it directly deals with the monitoring of the malaria vector in response to vector control interventions such as IRS and the distribution of LLINs. It is a key component for IRS programming, providing information on the impact of IRS on vector density and behavior in IRS spray areas. Entomological activities also assess the quality of the IRS operations, the decay rates of the insecticide applied, and the vector susceptibility to insecticides used for malaria vector control. AIRS Zambia is supporting the NMCC to generate data on key entomological indicators including:

- Malaria vector species identification
- Vector distribution and seasonality (vector density)
- Mosquito behavior
- Vector susceptibility to insecticides
- Quality assurance of IRS (decay of insecticide applied)
- Sporozoite rates, entomological inoculate rates (EIR) and parity rates

10.1 ENTOMOLOGY SURVEILLANCE BASELINE

AIRS collected baseline data using indoor CDC light trap, Pyrethrum Spray Catch and Human Landing Catch in six sprayed sites and four control sites in August to assess the species composition, the vector density and the malaria vectors behavior before the 2015 IRS campaign. A total of 5,118 mosquitoes were collected both from spray targeted and control sites including 725 Culicine (14%) and 4,393 Anopheline (86%). *An. funestus* s.l. was the most prevalent species (45%). Very few *Anopheles gambiae* s.l., were caught (0.3%). The other *anopheline* species found was 1842 *An. tenebrosus* (36%), 153 *An. tchekedii* (3%) and 67 *An. squamosus* (1.3%). From the 2316 *An.funestus* s.l. and 15 *Anopheles gambiae* s.l. collected from both sprayed and control sites in August, 46% (1,068) *An. funestus* s.l. and 80% (12) *An. gambiae* s.l. were collected from the spray targeted sites.

CDC light trap collection: The average density of *An. funestus* s.l. per trap per night was five (5) in the spray targeted sites and seven (7) in the control sites. The highest density of *Anopheles funestus* s.l. was recorded in Milenge (23.6 per trap per night in the control and 13.3 per trap per night in the intervention site) and Mwense districts (4.1 per trap per night in the control and 14.6 per trap per night in the sprayed site).This is due to the fact that intervention and control sites in these districts border the Luapula river where *Anopheles funestus* s.l. breeding sites are available all the year. Less than one *Anopheles gambiae* s.l. was caught per trap per night in both spray targeted (0.05) and control (0.03) sites this could be explained by the period of the baseline collection; performed in the dry season when there is very few *Anopheles gambiae* s.l. breeding sites.

Pyrethrum Spray Catch: An average of six (6) *Anopheles funestus* s.l. were found per room per day in the spray targeted areas against three (3) per room per day in the control site.

Human Landing Catch Collection: The mean biting rate of *Anopheles funestus* s.l. was 10.5 per person per night inside the house and 4.3 per person per night outside in the control sites versus 3 per person per night inside and 1.3 per person per night outside the house in the spray targeted site.

10.2 Quality Assurance of IRS and Insecticide Decay Rate

The initial cone bioassay was carried out in six districts. The wall bioassay was conducted 24 hours after spraying in 40 randomly selected houses. The Kisumu strain of *Anopheles gambiae* s.s. available in the insectary in the month of October was not enough to cover all the six sentinel sites for the T0 cone bioassay tests due to the ant invasion and destruction of some mosquitoes in the insectary in July-August. *Anopheles funestus* s.l. was collected using Backpack aspirators from Milenge and Mwense districts. Previous surveys showed that *An. funestus* is most abundant in Milenge, and Mwense districts. The WHO susceptibility test was done against pirimiphos-methyl CS (insecticide used for spraying) and showed 100% mortality. This known susceptible *Anopheles funestus* s.l. strain was used for the T0, T1 and T2 cone bioassay in Milenge, Mwense and Serenje districts. Susceptible Kisumu strain (*Anopheles gambiae* s.s.) reared in the insectary at the NMCC was used for the cone bioassay tests in the remaining three districts namely Katete, Isoka and Kasama. The two most commonly found surface types in the areas, cement and mud walls were tested.

The cone bioassay tests were done according to the WHO test procedure. During the tests, the number of mosquitoes knocked down after 30 min and dead after 24 hours were recorded. All the mosquitoes exposed were dead after 24h holding period. The 100% mortality rate was noted at all sites at T0, and T1 respectively 24 hours and one month after the spraying showing that the spraying was of good quality and pirimiphos-methyl CS was still effective one month post spray. Subsequent testing was done in December two months after IRS campaign, to determine the decay rate of insecticide applied on the walls. The mortality rate was 100% for both mud and cement sprayed walls except in Kasama district where the mortality rate in December was 96% for the mud and 98% for the cement sprayed walls.

In December 2015, two months after IRS campaign, the insecticide applied continued to be effective and the WHO minimum threshold of effectiveness was meet for both mud and cement walls (more than 80% of susceptible mosquitoes exposed were killed). Figures 5 and 6 below show the mortality rate at T0, 24 hours after spraying; at T1, one month in November and at T2, two months after the spraying in December.

FIGURE 5: MORTALITY OF KISUMU SUSCEPTIBLE STRAIN AFTER THE 24 HR HOLDING PERIOD IN OCTOBER AT T0; AFTER ONE MONTH IN NOVEMBER AT T1 AND AFTER TWO MONTH IN DECEMBER AT T3 THROUGH WHO CONE BIOASSAY TESTS IN ISOKA, KASAMA AND KATETE

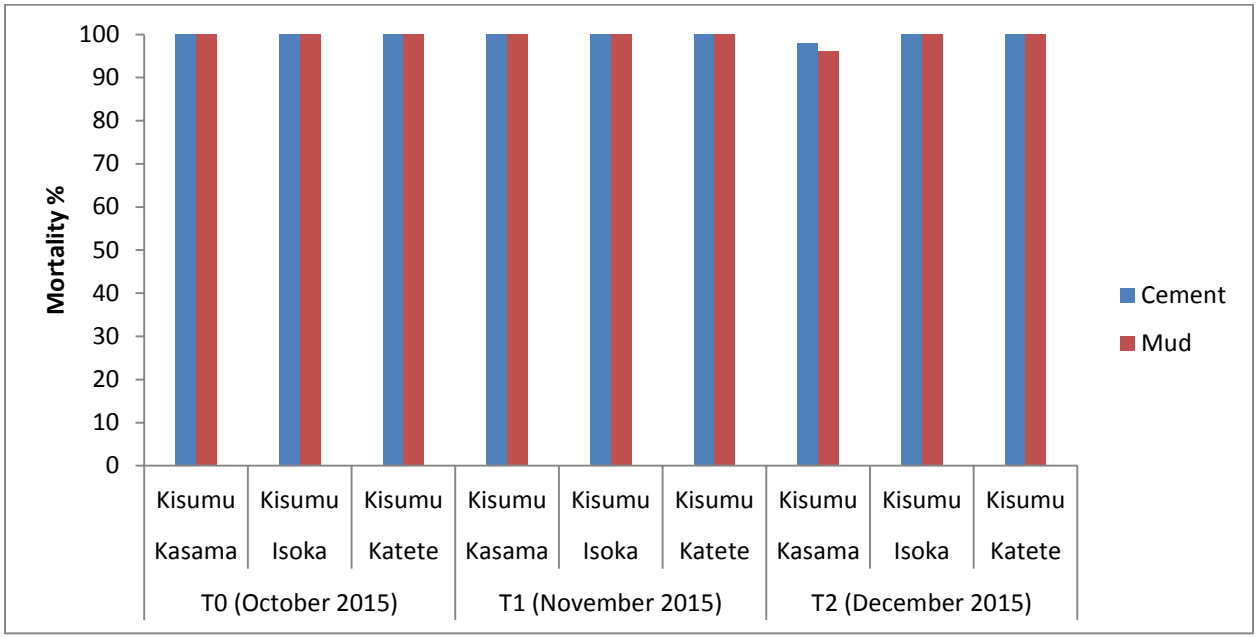
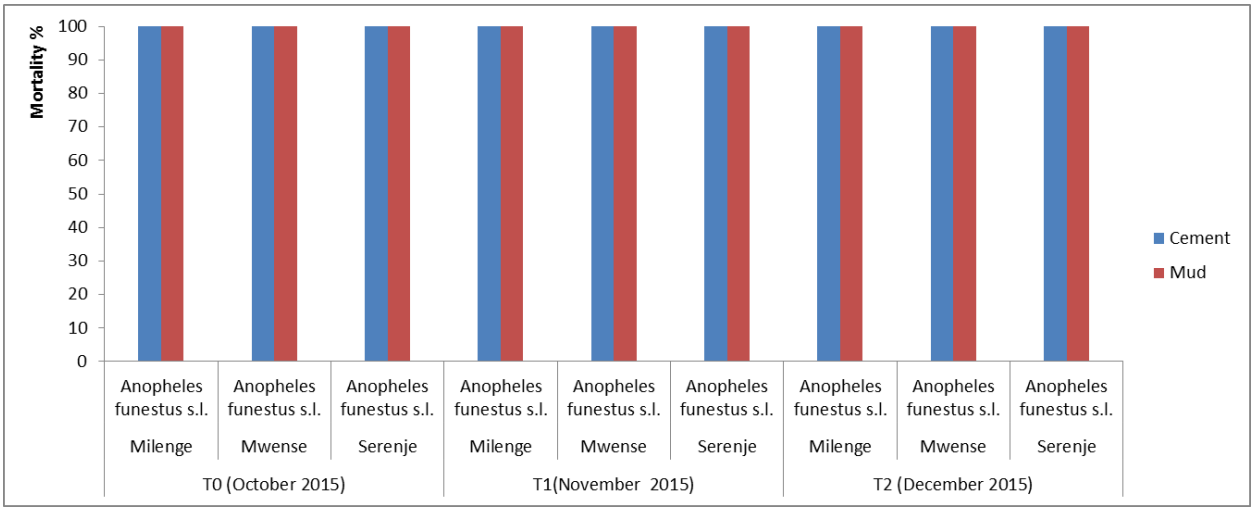


FIGURE 6: MORTALITY OF ANOPHELES FUNESTUS S.L. SUSCEPTIBLE STRAIN AFTER 30 MINS EXPOSURE AND 24 HR HOLDING PERIOD TO PIRIMIPHOS-METHYL CS IN OCTOBER AT T0; AFTER ONE MONTH IN NOVEMBER AT T1 AND AFTER TWO MONTHS IN DECEMBER AT T3 IN MILENGE, MWENSE AND SERENJE



10.3 Other Preliminary Entomological Surveillance Findings

From a total of 3,864 *Anopheles funestus* s.l. and 229 *Anopheles gambiae* s.l. collected in November one month after IRS campaign, an average of 96 *Anopheles funestus* s.l. and 9 *Anopheles gambiae* s.l. were

collected per intervention site as compared to an average of 822 *Anopheles funestus* s.l. and 44 *Anopheles gambiae* s.l. collected per control site.

The average density of *Anopheles funestus* s.l. per trap per night was 0.7 in the intervention sites and 12 per trap per night in the control site. The decrease of the vector density noted one month after spraying in sprayed sites compared to the increase in the control sites might be attributed to the effect of IRS. The average density of *Anopheles gambiae* s.l. remained low in both sprayed sites (0.13) and control sites (0.09). The mean indoor resting density of *Anopheles funestus* s.l. was five (5) *Anopheles funestus* s.l. per room per day in the intervention sites one month after IRS and is similar to the mean indoor resting density observed during the pre-spray period. In the control site, the indoor resting density per room per day increased from 3 *Anopheles funestus* s.l. per room per day before IRS to 11 *Anopheles funestus* s.l. per room per day one month after IRS campaign.

In indoor resting collection from PSC, the proportion of half and gravid *Anopheles funestus* s.l. was similar and relatively high in both sprayed and control sites (37%), one month after the IRS campaign. More than the half of the *Anopheles funestus* s.l. collected inside the houses (55% in the intervention sites and 50% in the control) by PSC was found fed. The human biting rate of *Anopheles funestus* s.l. was reduced from 3 bites per person per night during the pre-spray period to 0.5 bites per person per night one month after spraying in the intervention sites. On the contrary, in the control sites, the human biting rate increased from 10.5 bites per person per night to 19 bites per person per night. The drop of the human biting rate in the intervention sites one month after IRS campaign might be due to the IRS effect.

10.4 Training

AIRS conducted a series of in-class and practical workshops to prepare cadres of district-level environmental health officers and human landing collectors to manage entomological data collection in the sentinel sites. In addition, the AIRS Benin Technical Manager traveled from Benin to train the insectary technicians, three environmental health officers and the entomological coordinator on the identification of adult *Anopheles* mosquitoes to species using the Gilles & Coetzee 1987 identification key, as well as ovary dissection for parity determination, in February 2015.

10.5 Entomology Laboratory

PMI purchased and set up a modern prefab insectary at the NMCC. Through AIRS, PMI has furnished the insectary and is facilitating its usage.

10.6 Challenges

- Lack of enough equipment such as dissecting microscopes, CDC light trap batteries, back pack aspirator batteries for the six sentinel sites.
- Lack of adequate skills by some new district level personnel in areas such as morphological identification.
- Budget restrictions- prophylaxis for HLC is only done by NMCP since AIRS is not allowed to procure medicines
- Two control sites, Nandola in Kasama and Chilanga in Isoka districts, were sprayed in 2014 requiring the entomology to perform the entomological surveillance in four control sites instead of six.

11. Challenges and Lessons Learned

11.1 Challenges

The main challenges experienced during the IRS campaign included:

- One of the new features of AIRS Zambia's management approach for the 2015 campaign was hiring DCs who could manage the activities in their assigned districts. Since these were new staff, it took them a little time to come up to speed with all of the details of the campaign. The AIRS Zambia management team deployed master trainers in those districts that faced challenges so that DCs could get the skills necessary to coordinate field activities.
- Getting clearance from the ethics committee to conduct human landing catches (HLC) took a lot of time because it was not easy for the parties to agree on the best compensation for the community volunteers. An amount was eventually agreed on and the clearance was granted. Initially there was a challenge in obtaining prophlaxix medicines because these are not being procured by government or PMI. These were eventually procured by MACEPA for use in all the sentinel sites.
- In some districts, there was inadequate planning and coordination between spray teams and community mobilizers. AIRS Zambia had to briefly stop the spraying in Kasama and Nchelenge and re-engaged mobilizers to ensure that high quality mobilization was performed.
- In mSpray districts, maps for a number of spray areas were not pre-loaded on the tablets resulting in teams not being sure whether they were spraying in the right areas or not. Once the maps were loaded, this problem was resolved.
- The PMT Dimagi platform was not aggregating the spray performance figures as planned during the planning stage. The district figures remained static for a long time, in some case until the end of the spray campaign, thus making it difficult to use them for planning.
- AIRS Zambia experienced difficulty in monitoring sentinel sites due to long distances between the sites and the central level laboratory. The program will facilitate new logistic arrangements where mosquitoes are delivered to the central laboratory in the shortest period of time.
- While the introduction of control flow valves was important and helpful, they were distributed to the spray teams after the trainings had already been conducted. Some SOPs experienced valve blocking which slowed down their performance. In 2016, AIRS will ensure that SOPs are given adequate training on using the valves before the spray campaign.
- Although there was a marked improvement in 2015, there was still a lack of financial capacity by some vendors to provide services without an initial payment from AIRS Zambia. In the 2016 IRS campaign, AIRS Zambia will continue to explore suppliers who are financially stable so that the initial work does not stall.
- The NMCP and AIRS Zambia have faced challenges with the management and disposal of insecticide containers since Actellic 300 CS was introduced to the program in 2012 because there are no recycling companies to transform insecticide containers into non-consumptive products in Zambia. In November 2015, AIRS Zambia identified a local company to compress, bale and transport empty bottles to South Africa for recycling. The recycling company has been identified and a MoU signed.

- Challenges in the management of IRS waste has been exacerbated by the fact that 19,728 bottles of pesticides balance in stock from the 2014 spray campaign are expired because they were not delivered by the insecticide manufacturer with a full shelf life. These insecticides are currently being stored in Lusaka awaiting environmentally sound disposal.

11.2 Lessons Learned

- Engagement of community health volunteers as mobilizers at the operational site level to conduct mobilization enhanced the acceptability of IRS.
- AIRS Zambia implemented their pre-season spray activities well before the start of IRS, unlike last year, which greatly improved the team's readiness for the campaign.
- The involvement of DCs at the district level greatly improved the coordination of IRS activities at the district level.
- After the spray campaign is over, insecticides should be collected from all the districts and stored at central locations to ensure good storage.
- Dissemination of information to the communities on the importance of entomological activities should be improved.
- While mHealth activities (mobile technology activities including mSpray and mobile payments) are technologically advanced to implement and have the potential to allow management teams to access detailed data in real time, they require supportive infrastructure that might not be rolled out in Zambia yet and therefore extensive planning, which led to technical difficulties during piloting. This stretches manager's time and takes away from their ability to focus solely on IRS implementation.

Annex 1. Spray Progress and Coverage by District

Province	District	Spray Progress	Target	Found	Sprayed	Spray Coverage	Total Population Protected			
							Male	Female	Pregnant women	Children < 5
Eastern	Chadiza	89%	14,432	13,302	12,777	96%	25,650	25,523	1,207	8,892
	Chama	92%	17,293	17,724	15,966	90%	39,202	39,073	2,107	12,420
	Chipata	129%	40,981	61,671	52,930	86%	113,284	114,518	4,881	31,845
	Katete	90%	25,407	24,253	22,755	94%	43,622	44,893	1,502	13,178
	Lundazi	102%	26,101	27,423	26,714	97%	58,728	59,003	4,414	15,649
	Mambwe	88%	8,528	7,855	7,479	95%	15,942	15,612	723	4,827
	Nyimba	98%	14,168	14,152	13,829	98%	33,075	33,817	1,521	11,277
	Petauke	95%	33,123	34,023	31,526	93%	75,489	76,014	3,221	24,071
	Sinda	99%	6,639	6,889	6,598	96%	14,690	14,853	689	4,962
	Vubwi	97%	5,462	5,343	5,282	99%	12,581	12,596	882	3,769
	Total	**102%**	**192,134**	**212,635**	**195,856**	92%	**432,263**	**435,902**	**21,147**	**130,890**
Muchinga	Chinsali	121%	7,018	8,576	8,463	99%	22,466	22,992	1,571	6,404
	Isoka	95%	6,134	5,821	5,799	100%	13,255	13,141	541	4,195
	Mafinga	90%	6,341	5,903	5,716	97%	11,823	12,449	561	3,594
	Mpika	98%	12,001	12,407	11,707	94%	29,884	30,563	1,470	8,447
	Nakonde	104%	12,115	12,663	12,640	100%	27,089	26,655	1,723	8,012
	Shiwang'andu	86%	5,001	4,447	4,280	96%	10,814	10,533	411	3,515
	Total	**100%**	**48,610**	**49,817**	**48,605**	**98%**	**115,331**	**116,333**	**6,277**	**34,167**
Northern	Chilubi	78%	17,995	14,147	14,038	99%	36,382	37,390	1,983	13,156
	Kaputa	98%	10,854	11,385	10,642	93%	30,323	29,340	1,665	10,822
	Kasama	87%	25,969	23,365	22,574	97%	56,637	57,222	2,994	15,726
	Luwingu	94%	16,127	15,265	15,180	99%	39,814	39,211	2,282	12,466
	Mbala	98%	12,895	13,338	12,620	95%	33,098	32,730	1,553	10,734
	Mporokoso	101%	10,746	11,180	10,894	97%	27,759	27,851	1,042	9,319
	Mpulungu	97%	9,184	9,274	8,921	96%	24,514	25,069	1,589	8,661
	Mungwi	92%	11,890	11,324	10,967	97%	26,674	27,028	1,231	7,462
	Nsama	86%	9,233	8,144	7,959	98%	22,448	22,602	1,374	7,493
	Total	**91%**	**124,893**	**379,874**	**358,257**	**94%**	**845,243**	**850,678**	**43,137**	**260,896**

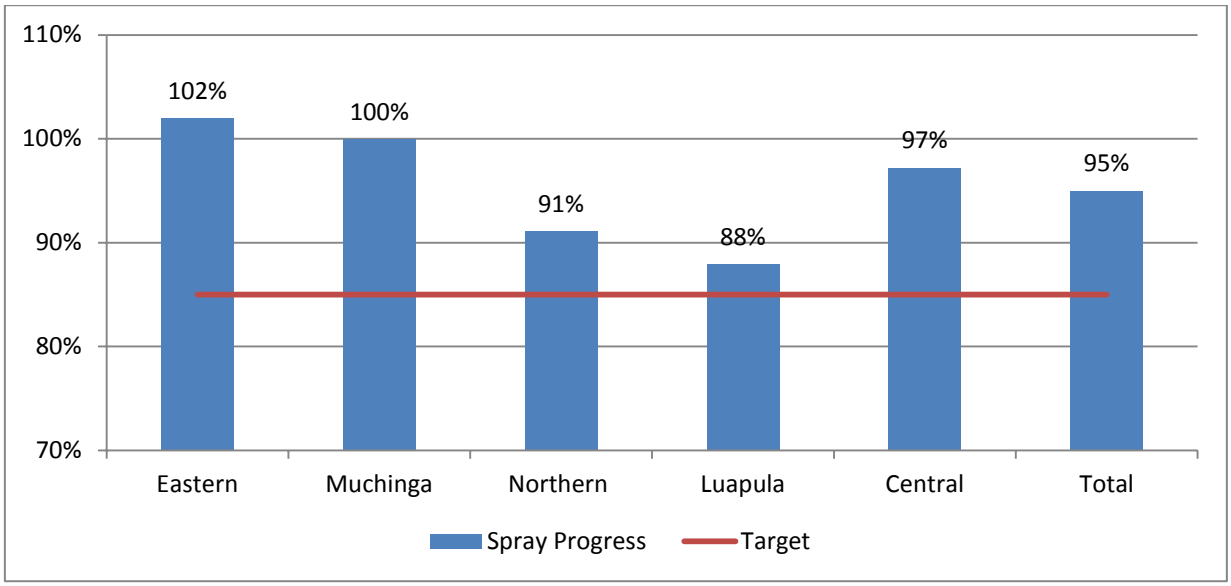
Luapula	Chembe	92%	5,366	5,544	4,940	89%	12,978	13,151	627	4,399
	Chiengi	77%	31,683	27,035	24,374	90%	64,328	61,365	3,440	20,143
	Chipili	115%	1,328	1,556	1,522	98%	4,083	4,102	188	1,428
	Kawambwa	70%	16,133	11,722	11,297	96%	29,979	30,372	1316	9,468
	Mansa	96%	23,624	24,142	22,604	94%	57,039	59,151	3,501	16,607
	Milenge	77%	2,381	1,933	1,842	95%	4774	4798	212	1548
	Mwansabombwe	82%	8,720	7,634	7,111	93%	19,721	20,487	1036	6,517
	Mwense	91%	19,970	18,910	18,136	96%	51,082	51,328	2,974	15,674
	Nchelenge	93%	26,169	25,168	24,219	96%	64,839	65,174	4,234	19,991
	Samfya	97%	30,787	30,111	29,984	100%	79,582	81,487	4,920	25,959
	Total	**88%**	**166,161**	**153,755**	**146,029**	**95%**	**388,405**	**391,415**	**22,448**	**121,734**
Central	Chitambo	101%	1,867	2,037	1,887	93%	4,982	5,043	293	1,816
	Luano	101%	957	1,051	970	92%	1,866	1,862	77	585
	Mkushi	101%	8,424	8,814	8,530	97%	19,311	18,843	769	5,745
	Serenje	87%	4,502	3,989	3,926	98%	8,435	8,207	383	2,127
	Total	**97%**	**15,750**	**15,891**	**15,313**	**96%**	**34,594**	**33,955**	**1,522**	**10,273**

Annex 2. Total Number of Structures Targeted and Enumerated

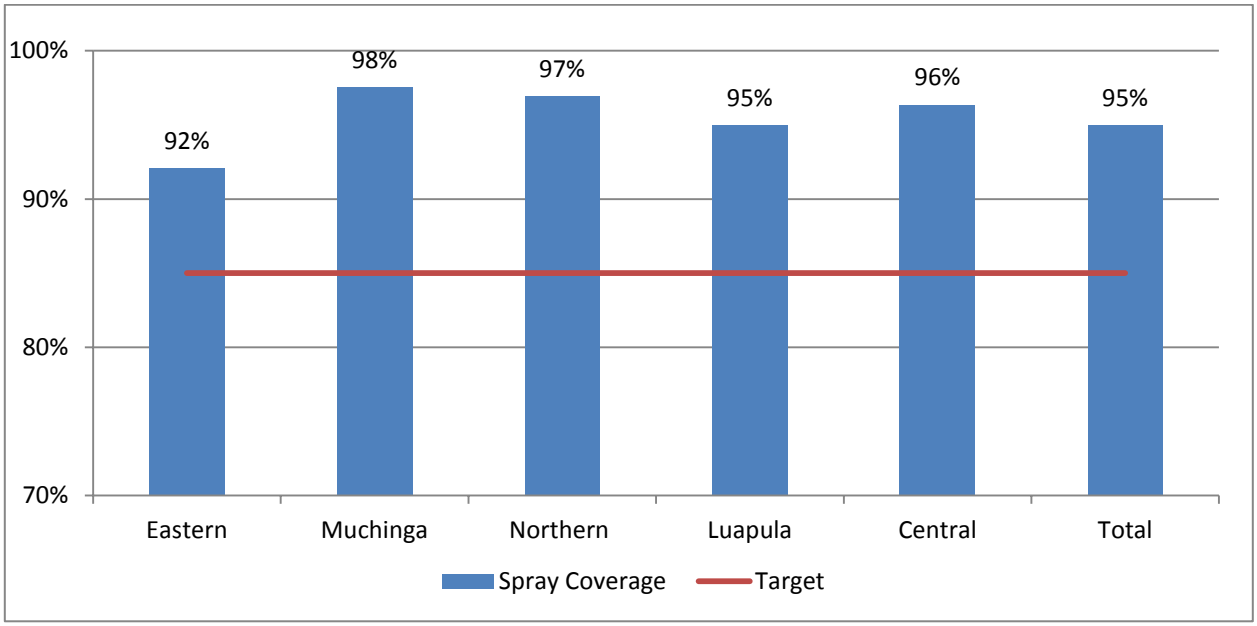
Province	District	No. of Structures Targeted	No. of Structures Enumerated
Eastern	Chadiza	14,432	20,242
	Chama	17,293	21,919
	Chipata	40,981	84,726
	Katete	25,407	84,726
	Lundazi	26,101	31,471
	Mambwe	8,528	53,100
	Nyimba	14,168	10,849
	Petauke	33,123	24,741
	Sinda	6,639	58,646
	Vubwi	5,462	7,392
	Total	**192,134**	**397,812**
Muchinga	Chinsali	7,018	20,310
	Isoka	6,134	13,989
	Mafinga	6,341	7,858
	Mpika	12,001	24,113
	Nakonde	12,115	19,447
	Shiwang'andu	5,001	9,041
	Total	**48,610**	**94,758**
Northern	Chilubi	17,995	16,728
	Kaputa	10,854	16,657
	Kasama	25,969	42,902
	Luwingu	16,127	22,894
	Mbala	12,895	33,722
	Mporokoso	10,746	18,246
	Mpulungu	9,184	20,783
	Mungwi	11,890	35,851
	Nsama	9,233	12,130
	Total	**124,893**	**219,913**

Luapula	Chembe	5,366	5,205
	Chiengi	31,683	33,224
	Chipili	1,328	4,752
	Kawambwa	16,133	20,832
	Mansa	23,624	32,360
	Milenge	2,381	3,002
	Mwansabombwe	8,720	8,879
	Mwense	19,970	20,673
	Nchelenge	26,169	33,195
	Samfya	30,787	40,613
	Total	**166,161**	**202,735**
Central	Chitambo	1,867	9,656
	Luano	957	6,192
	Mkushi	8,424	20,913
	Serenje	4,502	20,795
	Total	**15,750**	**57,556**
Grand Total		**547,548**	**972,774**

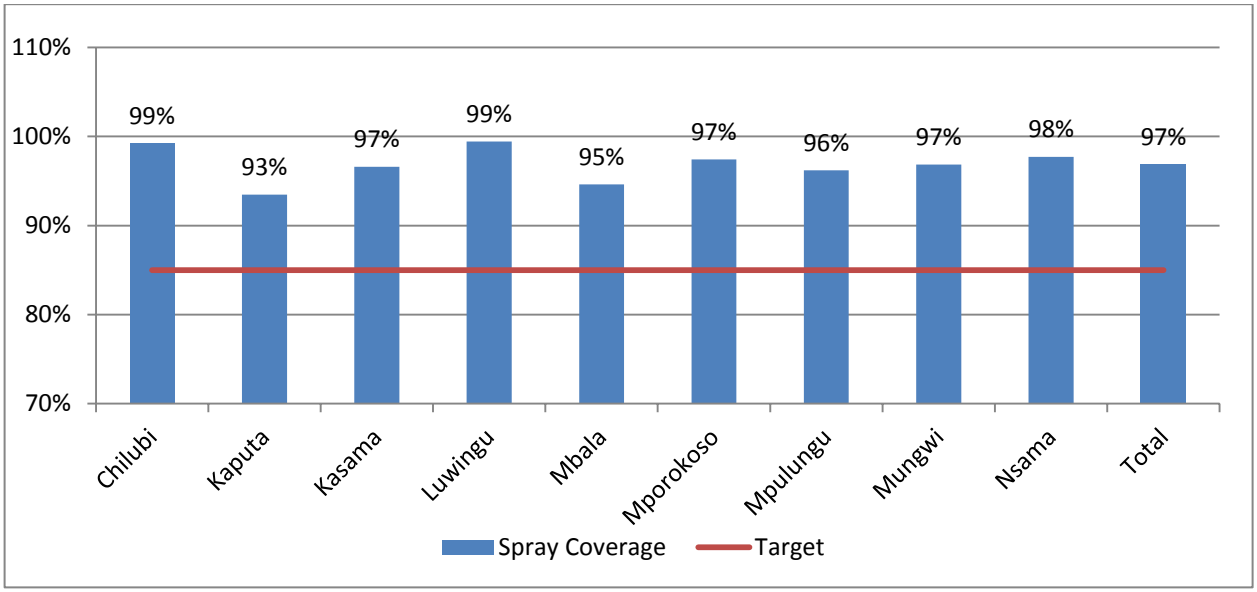
Annex 3: Provincial Spray Progress



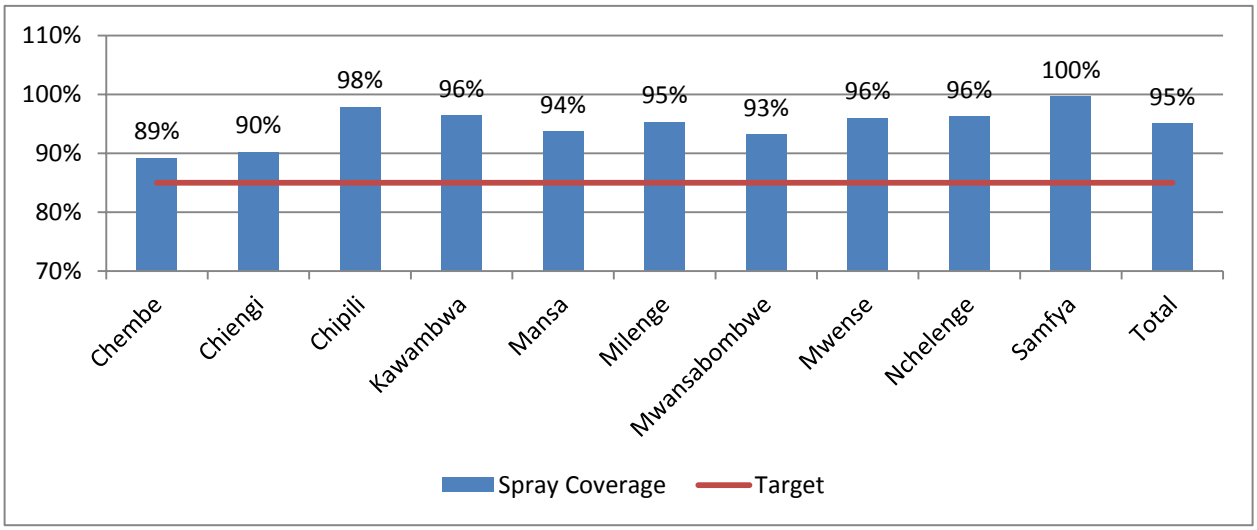
Annex 4: Provincial Spray Coverage



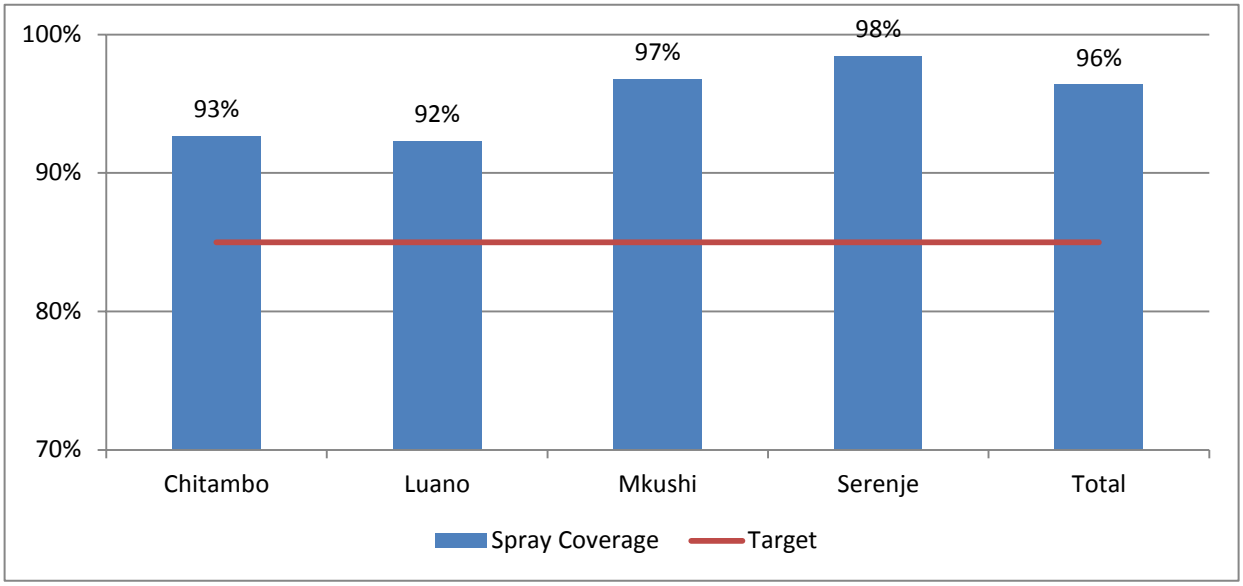
Annex 5: District Spray Coverage, Northern Province



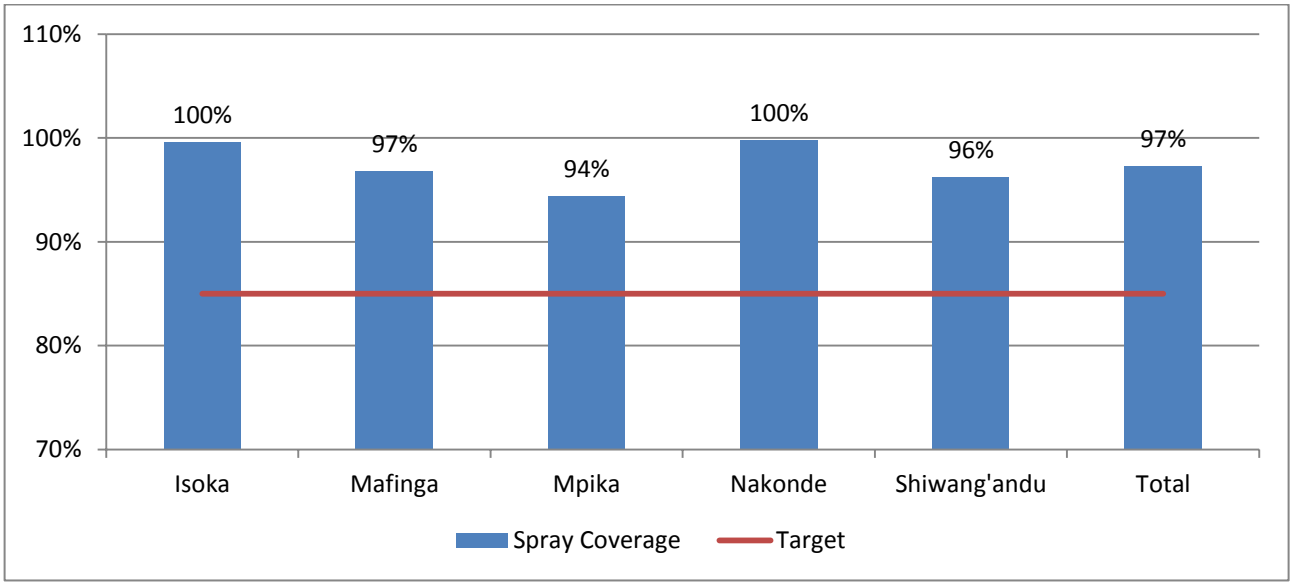
Annex 6: District Spray Coverage, Luapula Province



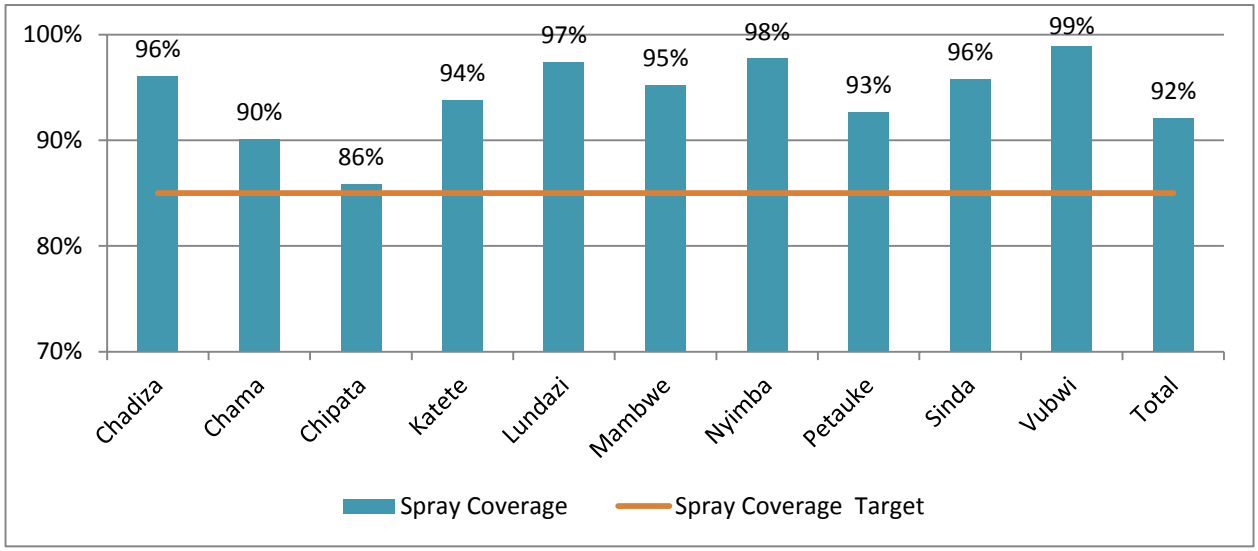
Annex 7: District Spray Coverage, Central Province



Annex 8: District Spray Coverage, Muchinga Province



Annex 9: District Spray Coverage, Eastern Province



ANNEX 10: M&E PLAN MATRIX – 2015 CAMPAIGN RESULTS

Performance Indicator	Data Source(s) and Reporting Frequency	Disaggregate	Annual Targets and Results					
			Year 1		Year 2		Year 3	
			Target	Results	Target	Results	Target	Results
Component 1: Establish cost-effective supply chain mechanisms and execute logistical plans								
1.1 Procurement								
1.1.1 Number and percentage of insecticide procurements that had a pre-shipment QA/QC test at least 60 days prior to spray campaign	Data source: Project records – insecticide procurements Reporting frequency: Each spray campaign	By Spray Campaign	1; 100%	1: 100%	TBD; 100%		TBD; 100%	
1.1.2 Number and percentage of international insecticide procurements delivered in country, at port of entry, at least 30 days prior to the start of spray operations	Data source: Project records – international procurements Reporting frequency: Each spray campaign	By Spray Campaign	1; 100%	1: 100%	TBD; 100%		TBD; 100%	
1.1.3 Number and percentage of international equipment procurements, including PPE, delivered in country, at port of entry, at least 30 days prior to start of spray operations	Data source: Project records Reporting frequency: Each spray campaign	By Spray Campaign	1; 100%	1: 100%	TBD; 100%		TBD; 100%	

Performance Indicator	Data Source(s) and Reporting Frequency	Disaggregate	Annual Targets and Results					
			Year 1		Year 2		Year 3	
			Target	Results	Target	Results	Target	Results
1.1.4 Number and percentage of local procurements for PPE delivered 14 days before the start of spray operations	Data source: Project records Reporting frequency: Each spray campaign	By Spray Campaign	1;100%	1:100	TBD; 100%		TBD; 100%	
1.1.5 Successfully completed spray operations without an insecticide stock-out	Data source: Project records Reporting frequency: Each spray campaign	By Spray Campaign	Completed	Completed	Completed		Completed	
1.2 In-Country Exemption and Custom Clearance Process								
1.2.1 Complete exemption and clearance process within the minimum 2 weeks	Data source: Project records Reporting frequency: Each spray campaign	By Spray Campaign	Completed	Completed	Completed		Completed	
1.3 In-Country Logistics, Warehousing, and Training								
1.3.1 Number and percentage of logistics and warehouse managers trained in IRS supply chain management	Data source: Training records Reporting frequency: Each spray campaign	By Spray Campaign By Gender	80; 100%	79[3]; 99%	TBD; 100%		TBD; 100%	

[3] One logistics and warehouse manager , from Nsama district, could not attend the training because he was unable to travel to the training due to personal reasons

Performance Indicator	Data Source(s) and Reporting Frequency	Disaggregate	Annual Targets and Results					
			Year 1		Year 2		Year 3	
			Target	Results	Target	Results	Target	Results
1.3.2 Number and percentage of base stores where physical inventories are verified by up-to-date stock records	Data source: Project records Reporting frequency: Each spray campaign	By Spray Campaign	40; 100%	39[4]; 98%	TBD; 100%		TBD; 100%	
1.3.3 Submit up-to-date inventory records 30 days after the end of each spray campaign	Data source: Project records Reporting frequency: Each spray campaign	By Spray Campaign	Completed	Completed	TBD; 100%		TBD; 100%	
Component 2: Implement safe and high-quality IRS programs and provide operational management support								
2.1 Planning and Design of IRS Programs								
2.1.1 Annual PMI AIRS country work plan developed and submitted on time	Data source: Project records Reporting frequency: Annually	By Spray Campaign	Completed	Completed	Completed		Completed	
2.1.2 Percentage reduction in project operational expenses per structure from the previous year,excluding insecticide costs.	Data source: Project financial records Reporting frequency: Annually	By Spray Campaign	5%	8.6%	5%		5%	
2.2 Support of Safety and Health Best Practices and Compliance with USAID and Host Country Environmental Regulations								
2.2.1 SEA/letter reports submitted on time based	Data source: Project records – submitted SEAs/	By Spray Campaign	Completed	Completed	Completed		Completed	

[4] AIRS did not spray in one district, Lunga, because the district was disqualified based on environmental criteria stipulated in the BMP

Performance Indicator	Data Source(s) and Reporting Frequency	Disaggregate	Annual Targets and Results					
			Year 1		Year 2		Year 3	
			Target	Results	Target	Results	Target	Results
on schedule agreed upon with the-PMI COR team	letter reports Reporting frequency: Each spray campaign							
2.2.2 Number of spray personnel trained in environmental compliance and personal safety standards in IRS implementation	Data source: Project records – Training reports Reporting frequency: Each spray season	By Spray Campaign By Gender	1,515[5]	1,914[6]	TBD		TBD	
2.2.3 Number of health workers receiving insecticide poisoning case management training	Data source: Project records – Training reports Reporting frequency: Each spray season	By Spray Campaign By Gender	80; men: 60 women: 20	77; men: 61 women:16	TBD		TBD	
2.2.4 Number of adverse reactions to pesticide exposure documented	Data source: Incident report forms Reporting frequency: Each spray campaign	By Spray Campaign By Residential/ occupational exposure	0	0	0		0	
2.2.5 Number and percentage of soak pits	Data source: Project records – Reports	By Spray Campaign	80[7]; 100%	89[8];125%	TBD; 100%		TBD; 100%	

[5] This number includes 1,317 SOPs/TLs, 118 Supervisors and 80 Stores Officers

[6] This includes 1,653 SOPs/TLs, 182 Supervisors and 79 Stores Officers
[7] This number includes 40 soak pits and 40 store houses
[8] This number includes 50 soak pits and 39 store houses. There were additional soak pits that were renovated before commencement of the 2015 spray campaign

Performance Indicator	Data Source(s) and Reporting Frequency	Disaggregate	Annual Targets and Results					
			Year 1		Year 2		Year 3	
			Target	Results	Target	Results	Target	Results
and storehouses inspected and approved prior to spraying	submitted by district environmental officers Reporting frequency: Each spray season	By Soak Pit By Storehouse						
2.3 Conduct Communications Activities and Community Mobilization								
2.3.1 Number of radio spots and talk shows aired	Data source: Project records Reporting frequency: Per spray campaign	By Spray Campaign	113	833[9]	TBD		TBD	
2.3.2 Number of IRS print materials disseminated	Data source: Project records Reporting frequency: Semi-annually	By Spray Campaign By Type of printed material and message(s)	2,000[10]	39,000[11]	TBD		TBD	
2.3.3. Number of people reached with IRS messages via door-to-door mobilization	Data source: Mobilization Data Collection Forms Reporting frequency: Daily per mobilization conducted	By Spray Campaign By Gender	1,043,397	1,190,422[12]	TBD		TBD	

[9] This number includes 824 radio sports (415 PMI; 409 DFID) and 9 radio talk shows (4 PMI; 5 DFID)
[10] 2000 posters (1,250 PMI, 750 DFID)
[11] This number includes 30,000 brochures (18,750 PMI, 11250 DFID) and 9,000 posters (5,625 PMI, 3,375 DFID)
[12] This figure includes 538,122 males and 652,300 females

Performance Indicator	Data Source(s) and Reporting Frequency	Disaggregate	Annual Targets and Results					
			Year 1		Year 2		Year 3	
			Target	Results	Target	Results	Target	Results
2.4 Spray Targeted Structures According to Technical Specifications								
2.4.1 Number of structures targeted for spraying	Data source: Previous spray campaign data, enumeration data (targets); Daily Spray Operator Forms (results) Reporting frequency: Daily per spray campaign	By Spray Campaign	438,252	549,520	TBD		TBD	
2.4.2 Number of structures sprayed with IRS	Data source: Daily Spray Operator Forms Reporting frequency: Daily per spray campaign	By Spray Campaign	372,514	519,598	TBD		TBD	
2.4.3 Percentage of total structures targeted for spraying that were sprayed with a residual insecticide (Spray Coverage)	Data source: Daily Spray Operator Forms Reporting frequency: Daily per spray campaign	By Spray Campaign	85%	95%	85%		85%	
2.4.4 Number of people residing in structures sprayed (Number of people protected by IRS)	Data source: Daily Spray Operator Forms Reporting frequency: Daily per spray campaign	By Spray Campaign By Gender By pregnant women	2,689,782	2,544,290[13]	TBD		TBD	TBD

[13] This number includes 1,268,242 males and 1,276,048 females of which 67,107 are pregnant women and 392,903 are children

Performance Indicator	Data Source(s) and Reporting Frequency	Disaggregate	Annual Targets and Results					
			Year 1		Year 2		Year 3	
			Target	Results	Target	Results	Target	Results
		By children <5 years old						
Component 3: Ongoing Monitoring and Evaluation and Quality Control Measures								
3.1 Submit AIRS Zambia M&E Plan to PMI for approval	Data source: Project records Reporting frequency: Semi-annual	By Spray Campaign	Completed	Completed	Completed		Completed	
3.2 Conduct a post-spray data quality audit within 60 days of completion of spray operations	Data source: Spray operations reports Reporting frequency: Per spray campaign	By Spray Campaign	Completed	Not Completed	Completed		Completed or N.A.	
Component 4: Contribute to Global and Country-Level IRS Policy Setting and Develop and Disseminate Experiences and Best Practices								
4.1 Number of guidelines/checklists/tools related to IRS operations developed or refined with project support	Data source: Project records – Activity reports Reporting frequency: Semi-annually	By Spray Campaign By guideline/ checklist/tool	3	3[14]	TBD		TBD	

[14] IRS cards and mobilization forms were developed while SOP forms were refined

Performance Indicator	Data Source(s) and Reporting Frequency	Disaggregate	Annual Targets and Results					
			Year 1		Year 2		Year 3	
			Target	Results	Target	Results	Target	Results
4.2 Number of articles/best practices documents published	Data source: Project records – Activity reports Reporting frequency: Semi-annually	By Spray Campaign By IRS Technical Area	2	0	TBD		TBD	
4.3 Number of best practice presentations given at national/ regional/international workshops and conferences	Data source: Project records – Activity reports Reporting frequency: Semi-annually	By Spray Campaign By IRS Technical Area	5	0	TBD		TBD	
4.4 Number of enterprises engaged through public-private partnerships	Data source: Project records – Activity reports Reporting frequency: Semi-annually	By Spray Campaign	2	0	TBD		TBD	
Component 5: Contribute to the collection and analysis of Routine entomological and epidemiological data								
5.1 Support entomological monitoring activities and insecticide resistance strategies								
5.1.1 Number of entomological sentinel sites supported by the PMI AIRS Project established to monitor vector bionomics and behavior (vector species, distribution, seasonality, feeding time, and location)	Data source: Entomological reports Reporting frequency: Annually	By Spray Campaign	6	6	TBD		TBD	

Performance Indicator	Data Source(s) and Reporting Frequency	Disaggregate	Annual Targets and Results					
			Year 1		Year 2		Year 3	
			Target	Results	Target	Results	Target	Results
5.1.2 Number and percentage of entomological monitoring sentinel sites measuring all the five primary PMI entomological monitoring indicators	Data source: Entomological reports Reporting frequency: Annually	By Spray Campaign	6;100%	6;100%	TBD		TBD	
5.1.3 Number and percentage of entomological monitoring sites measuring at least one secondary PMI indicator	Data source: Entomological reports Reporting frequency: Annually	By Spray Campaign	6;100%	6;100%	TBD		TBD	
5.1.4 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	Data source: Entomological reports Reporting frequency: Annually	By Spray Campaign By Insecticide class	6;100%	6;100%	TBD		TBD	
5.1.5 Number of wall bioassays conducted within 2 weeks of spraying to evaluate the quality of IRS	Data source: Entomological reports Reporting frequency: Per spray campaign	By Spray Campaign	36	39	TBD		TBD	

Performance Indicator	Data Source(s) and Reporting Frequency	Disaggregate	Annual Targets and Results					
			Year 1		Year 2		Year 3	
			Target	Results	Target	Results	Target	Results
5.1.6 Number of wall bioassays conducted after the completion of spraying at monthly intervals to evaluate insecticide decay	Data source: Entomological reports Reporting frequency: Per spray campaign	By Spray Campaign	252	117	TBD		TBD	
5.1.7 Number of vector susceptibility tests for different insecticides conducted in selected sentinel sites	Data source: Entomological reports Reporting frequency: Per spray campaign	By Spray Campaign	72	26	TBD		TBD	
5.2 Support Epidemiological Malaria Data Collection and Analysis								
5.2.1 Collect routine epidemiological data	Data source: *Project Reports* Reporting Frequency: Annually	By Spray Campaign	NA	NA	TBD		TBD	
5.2.2 Number of targeted health facilities with routine epidemiological malaria data collection supported by the PMI AIRS Project	Data source: Epidemiological reports Reporting frequency: Annually	By Spray Campaign	NA	NA	TBD		TBD	
Component 6 (Cross-cutting): Capacity Building, Knowledge Transfer, Gender Inclusion								
6.1 Increasing the Role of Women and Addressing Gender Barriers								
6.1.1 Number of people	Data source: Project	By Spray	1,435; 40%	1,912[15];	TBD		TBD	

[15] This includes 1,653 SOPs/TLs, 182 supervisors, 77 clinicians

Performance Indicator	Data Source(s) and Reporting Frequency	Disaggregate	Annual Targets and Results					
			Year 1		Year 2		Year 3	
			Target	Results	Target	Results	Target	Results
trained to deliver IRS in target districts	records – Training reports Reporting frequency: Semi-annually	Campaign By Spray Campaign By Gender Percentage of Women Trained	women	men: 1,347 women: 565 30% women				
6.1.2 Total number of people trained to support IRS in target districts	Data source: Project records – Training reports Reporting frequency: Semi-annually	By Spray Campaign By Spray Campaign By Gender Percentage of women trained	1,665; 40% women	2,105; men: 1,480 women: 625 30% Women	TBD		TBD	
6.1.3 Number and percentage of women recruited (i.e. number/percentage of women on the selection list) for IRS employment	Data source: Project records – Recruitment reports reports Reporting frequency: Semi-annually	By Country	506; 40% women	510; 40.3% women	TBD		TBD	
6.1.4 Number of people trained as IRS Training of Trainers	Data source: Project records – Training reports Reporting frequency:	By Spray Campaign By Gender	118; 40% women	182; men: 144 women: 38 21%	TBD		TBD	

Performance Indicator	Data Source(s) and Reporting Frequency	Disaggregate	Annual Targets and Results					
			Year 1		Year 2		Year 3	
			Target	Results	Target	Results	Target	Results
	Semi-annually	Percentage of women trained		women				
6.1.5 Total number of people hired to support IRS in target districts	Data source: Project records – Contracts signed Reporting frequency: *Semi-annually*	By Spray Campaign By Gender Percentage of women hired	1,266; 40%	1,709; men: 1199 women: 510 30%	TBD		TBD	
6.1.6 Number of women hired in supervisory roles in target districts (this number includes site supervisors, team leaders, M&E assistants and others who supervise seasonal staff)	Data source: Project records – Contracts signed Reporting frequency: Semi-annually	By Spray Campaign Percentage of women hired By role	121[16]	78[17]	TBD		TBD	
6.1.7 Number of staff (permanent and seasonal) who have completed gender awareness training	Data source: Project records – Training reports Reporting frequency: Semi-annually	By Spray Campaign By Gender Percentage	1,544	1,983[18] men: 1,380 women:603 30%	TBD		TBD	

[16] This number includes 105 Team Leaders and 16 M&E Assistants. In Zambia we do not hire but do engage supervisors who are MOH staff
[17] This number includes 67 Team Leaders and 11 M&E Assistants
[18] This number includes the following: 1,653 SOPS, 182 Supervisors, 114 Data Capture Personnel, 19 DCs and 15 AIRS Technical Staff

Performance Indicator	Data Source(s) and Reporting Frequency	Disaggregate	Annual Targets and Results					
			Year 1		Year 2		Year 3	
			Target	Results	Target	Results	Target	Results
		of women		women				
6.2 Capacity Building								
6.2.1 Number of government officials trained in IRS oversight	Data source: Project records – Training reports Reporting frequency: Semi-annually	By Spray Campaign By Gender Percentage of Women	118: men: 71 women:47 40% women	62: men: 55 women:7 11% women	TBD		TBD	
6.2.2 Implement all activities outlined in their yearly Capacity Building Action Plan	Data source: Project records – Capacity assessment reports Reporting frequency: Semi-annually	By Spray Campaign	Completed	Not Completed	Completed		Completed	
6.2.3 COUNTRY government implements at least one aspect of the IRS program independently.	Data source: Project records – MOUs Reporting frequency: Semi-annually	By Spray Campaign	Completed	Completed[19]	Completed		Completed	

[19] Planning, logistics and implementation

Annex 11: Environmental Mitigation and Monitoring Report

Mitigation Measure	Status of Mitigation Measures	Outstanding issues relating to required conditions	Remarks
1a. Pre-contract inspection and certification of vehicles used for pesticide or spray team transport.	Pre- contract inspection and certification of vehicles was conducted between September 9 and October 10, 2015. In total 75 vehicles were inspected but only 67 vehicles were hired	Some trucks were not retrofitted with benches and railings during the period under review, whereas others did not carry comprehensive insurance but had a third party insurance cover	After the inspections all the truck hired were retrofitted with benches and hand rails. The insurance cover was also upgraded to a comprehensive cover
1b. Driver training	A total of 83 drivers were trained during driver trainings which were conducted between September 9 and October 10 in Lusaka, Chipata, Mansa and Kasama		
1c. Cell phone, personal protective equipment (PPE) and spill kits on board during pesticide transportation.	All drivers were in possession of a cell phone as a pre-requisite for hiring and were each assigned adequate PPE after being trained. Whereas Spill management Kit were provided by the transport vendors. In order to ensure that		All Drivers were provided with PPE before the onset of the spray campaign and the 19 instances it was reported that drivers had no PPE was because the monitors wanted to find drivers donned in PPE even if they were not

	the required conditions were adhered a total of 521 morning mobilization inspections were conducted. On 17 instances, the vehicle was reported not to have a spill kit and the driver was without the required PPE in 19 instances		handling chemicals. However, it was discussed and information was disseminated to say drivers do not need to don in their PPE but it has to be available for use when about to handle pesticides or conduct decontamination
1d. Initial and 30-day pregnancy testing for female candidates for jobs with potential pesticide contact.	Initial pregnancy tests were conducted before hiring Spray Operators, washers and Store Assistants between September 1 and 28, 2015. A second round of pregnancy tests were conducted only for the districts that had a spray calendar of over 30 days		
1e. Health fitness testing for all operators	All the SOPs hired were subjected to medical examinations prior to their engagement. Examination conducted involved physical examinations, HB, blood pressure and pregnancy tests		
1f. Procurement of, distribution to, and training on the use of PPE for all workers with potential pesticide contact.	Both international and local procurement were carried out successfully prior to all trainings. The use of PPE was successfully demonstrated during TOTs, Cascade and Store keeper trainings prior to the commencement of the spray campaign.		

1g. Training on mixing pesticides and the proper use and maintenance of spray pumps.	The correct mixing procedure for pesticides, including triple rinse of the bottles, was included in all trainings. A total of 146 Supervisors were trained during TOTs whereas 229 Team Leaders were trained during cascade training as pump mechanics for the maintenance of the pumps		
1h. Provision of adequate facilities and supplies for end-of-day cleanup,	All the IRS operational bases lie on health center grounds and a total of 12 new IRS operational sites with facilities such store room and soak pits were established whereas 6 old storage facilities were rehabilitated. The ten (10) soak pits that were in bad condition during PSECA were renovated as well as 65 MSP and 93 rinse barrels were provided prior to the commencement of the campaign. In overseeing the program adherence to the BMP guidelines, a total of 450 end of day cleanup inspections were conducted by both AIRS Staff and supervisors from MOH. However, on 5 instances it was reported that some sites had no wash facilities with soap and water available for operators. This could have been the time SOPs left for camping because some camping	Erratic water system	All the IRS operational bases had wash facilities with adequate water, soap, dishes and privacy. The camping sites also had temporary wash facilities which were certified prior to the commencement of the spray campaign. Some districts however experienced erratic water systems and as such, washers were advised to draw and reserve water for use during end of day clean up before SOPs could return from the field.

	sites had no running water but relied on water from the well.		
1i. Enforce clean-up procedures.	The clean-up procedures for the pumps was done in designated wash areas and supervised by the ECO, IRS managers, DCs and other AIRS staff present. In total 450 inspections were conducted by the aforementioned staff. The number of non-compliant issues reported for the ## sites inspected were 121 with one issue coming out prominent on 21 occasions.	Team Leaders not supervising cleaning and wash ups	In the initial stages of IRS operations, Team Leaders did not take time to supervise the end of day cleanup activities but they were later spoken to by the AIRS staff that had spread out in all the 39 districts and they gained momentum as the campaign progressed. As such there were no non-compliant issues of such nature during the later stages of IRS.
2a. IEC campaigns to inform homeowners of responsibilities and precautions.	Two thousand four hundred and eighty (2408) community mobilizers were trained to conduct door to door community sensitization on IRS with the primary focus regarding informing homeowners on what to do before, during and after administering IRS. All the districts conducted radio programs to champion IEC campaigns and in some districts IEC was enhanced by using drama groups		
2b. Prohibition of spraying houses that are not properly prepared.	SOPs were advised not to administer IRS in structures that were not properly prepared, and in order to strengthen this requirement, a total of 871		

	Homeowner preparations and spray operator performance inspections were conducted by both MOH and AIRS staff. In the initial stages of the campaign, on 51 instances some structures were reported to have been sprayed without being properly prepared.		
2c. Two-hour exclusion from house after spraying	In most of the districts, SOPs informed the homeowners to keep the windows and doors of the sprayed structure closed for two hours, after which doors and windows were opened to allow circulation of air for at least 30 minutes before cleaning. Dead insects were to be discarded into a pit latrine or buried together with water used to mop the floor in a hole. The ECO, DCs and Supervisors played a pivotal role in championing this requirement and as such, from a total of 871 inspections conducted, only on 4 instances was the structure sprayed without informing homeowners of the 2 hour exclusion requirement.		
2d. Instruct homeowners to wash itchy skin and go to health clinic if symptoms do not subside.	All homeowners were instructed to wash their skin with plenty of water and soap if they experienced itching or visit the		Most of the SOPs left information with homeowners but it was observed that homeowners could at times forget the post spray

	nearest clinic if itching persisted except on 28 instances out of the 871 inspections conducted when a structure was sprayed without informing residents of post spray instructions.		instructions which were left with them. However, these instructions were consistently repeated by the MOH and AIRS employees deployed for monitoring and supervision
3a. Indoor spraying only.	The ECO, DCs, TLs and supervisors worked so hard in ensuring that all spray-able surfaces were sprayed including the wall, ceiling, and the eaves of all sleeping spaces except on 24 instances out of the 871 inspections conducted when it was reported that SOPs were spraying wrong surfaces such as floors, metal roof, the outside of door, glass etc.		The 24 instances of non-compliant towards this requirement occurred in the first few days of IRS operations before SOPs had gained momentum. All the outstanding issues were later addressed and as the campaign progressed corrective measures were thus put in place to stop such vices
3b. Training on proper spray technique	TLs and SOPs underwent a rigorous training on the proper spray techniques during cascade trainings that were held between September 7 and 25, 2015 and out of the 871 inspections conducted, only on 5 instances was this requirement reported to be non-compliant.		When the spray campaign just began SOPs who were new in the program had not gained grip on the spray techniques but this was controlled as the program progressed and could be noticed from the smaller number of non-compliant issues reported as compared to compliant ones.
3c. Maintenance of pumps	Spray Pumps were on daily basis serviced by the TLs and supervisors prior to the deployment of SOPs. Out of 871 inspections conducted, on 27 instances pumps were reported to be leaking while in the field.		Apart from servicing the pumps during morning mobilization TLs and Supervisors were also repairing pumps that happened to be defective while in the field so that SOPs could resume work immediately

	However, TLs and supervisors were always in the field to attend to such incidences and repair the defective pumps so that SOPs could in no time resume work		
4a. Choose sites for disposal of liquid wastes according to PMI BMPs.	Selecting the soak pit sites for liquid waste disposal was jointly done by the ECO, ZEMA, and MOH district representative and was supervised by the COP in accordance with the PMI BMP. In total 50 fixed soak pits and 65 MSP were inspected and were in use during the 2015 IRS campaign		
4b. Construct soak pits with charcoal to adsorb pesticide from rinse water.	Thirteen (13) new soak pits with a 8 x 4m wash bay were constructed as per design demonstrated in the BMP and was supervised by the ECO, DCs, and MOH district representative before approval by ZEMA		
4c. Maintain soak pits as necessary during season.	A total of 10 old soak pits that were in bad condition during PSECA were renovated and began serving as a filter. All soak pits were cleared of vegetation and were fenced in order to block unauthorized entry	Inadequate gravel in the soak pit at Nchelenge IRS operational base	The gravel which was earlier used contained soil particles and after two day of IRS operation the soak pit clogged until the right gravel was used and the soak pit began acting as a filter
4d. Inspection and certification of solid waste disposal sites before spray campaign.	Solid waste disposal sites were inspected by the ECO, Chief Environmental Health Officer (CEHO) and the AIRS Operations	Mismanagement of solid waste disposal sites in provincial capitals	Most of the dumpsites in Zambia are not properly managed and thus there's a lot of scavenging that happens around. As such all

	Manager before the commencement of the campaign.		uncontaminated wastes such as old overalls, bags and used mutton clothes will be given to deserving SOPs after thorough washing with soap whereas worn out helmets, face shields and gloves after being thoroughly washed with soap will be buried at provincial dumpsites. Lastly all the empty bottles together with carton boxes will be collected from the districts and taken to central level at Lusaka Cleansing Depot awaiting thorough cleaning with soap and water, removal of labels and seals, compression and bailing prior to their shipment to the Republic of South Africa (RSA) for the purpose of recycling since there are no recycling companies to sanction the recycling of these materials in Zambia. Contaminated boxes as well as nose masks will be incinerated at ZEMA approved provincial hospital and/ or the University Teaching Hospital incinerators whereas uncontaminated boxes will be supplied to Zambezi Paper Mills as raw material in paper production

4e. Monitoring waste storage and management during campaign.	All the IRS solid waste generated were segregated in different categories as paper, plastic, rubber, cloth, etc. and were stored in labeled refuse bags. However, from the 165 inspections conducted, on 8 instances the stock of waste (especially, used packaging and dust masks) was reported not to have been recorded		Recording and labelling of IRS solid waste was the responsibility of storekeepers and like earlier stated most of the storekeepers were new in the program and only focused on monitoring and recording the movement of pesticides and paid little attention to recording IRS waste. However, when this was noted via smart phone reports, storekeepers were re-oriented by the ECO and DCs on the best practices regarding the handling of IRS waste. Therefore, such vices did not continue in the later stages of IRS operations
4f. Monitoring disposal procedures post-campaign.	The ECO will monitor the post spray campaign solid waste disposal procedure. Disposal from the district level to the central warehouse at the province for uncontaminated solid waste and to the final designation for proper disposal at the ZEMA-approved provincial dump sites will occur in February 2016. Pesticide-contaminated wastes such as used nose masks will be incinerated at the ZEMA University Teaching Hospital (UTH) approved incinerator by February 2016.	Recycling of empty pesticide containers	The MOH and Zambia AIRS project have been faced with challenges with regard to the disposal of empty containers since the introduction of Actellic 300 CS in the program in 2012. Therefore, all the empty bottles will be delivered to the central level for thorough cleaning, removal of labels and seals as well as compressing and baling prior to shipping to South Africa for the purpose of recycling

5a. Maintain records of all pesticide receipts, issuance, and return of empty sachets/bottles.	Records of all pesticides receipts from central stores, issuances and returns of empties were kept on the stock cards with backups in ledger books at central and district level, as well as the sub-districts store. However, a total of 165 inspections were conducted and on 4 instances the sum of the stock balance on the stock card + the stock issued out for the day + the stock balance of empty sachets/bottles was not equal to the opening balance in the ledger	The Sum of the stock balance on the stock card + the stock issued out for the day + the stock balance of empty sachets/bottles not equal to the opening balance in the ledger	Non-compliant issues towards this requirement mostly occurred in the first instances of IRS operations and were rectified by conducting a physical count of all the stocks until reconciliation between empty bottles and full stocks was reached. What could have attributed to this anomaly was the fact that most of the stores officer were new in the program and made mistakes with regard to the entries on the stock control cards.
5b. Reconciliation of number of houses sprayed vs. number of sachets/bottles used.	Based on the total number of pesticides used against total number of structures sprayed, the average structures sprayed per bottle of insecticide was 4.0. This therefore means that, the standard average of 3.64 structures to be sprayed per bottle of insecticide was exceeded by 0.36.		Exceeding the targeted average structures to be sprayed per bottle of insecticides could be attributed to the fact that IRS Zambia used CFVs for this first time. And this may have led to controlled usage of insecticides.
5c. Visual examination of houses sprayed to confirm pesticide application.	Visual examination of houses sprayed was conducted by observing the traces of the sprayed chemical of the walls, ceilings, and eaves during home owner preparation and spray operator performance inspections as were as data collection		

	verification exercise by supervisors, DCs, M&E assistants and any other AIRS staff.		
5d. Perform physical inventory counts during the spray season.	ECO, DCs and Logistics ensured physical inventory taking during and after the spray season. A total of 165 inspections were conducted throughout the campaign		