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Indoor Residual Spraying (IRS 2) Task Order Six

ZAMBIA 2017
END OF SPRAY REPORT

SPRAY CAMPAIGN: OCTOBER 2 – DECEMBER 16, 2017

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ZAMBIA 2017
END OF SPRAY REPORT

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ACRONYMS

AIRS	Africa Indoor Residual Spraying
CFV	Constant Flow Valve
CEHO	Chief Environmental Health Officer
DC	District Coordinator
DCV	Data Collection Verification
DEC	Data Entry Clerk
DFID	(UK) Department for International Development
DHO	District Health Office
DOS	Daily Observation of Spray
EC	Environmental Compliance
ECO	Environmental Compliance Officer
EE	Error Eliminator
GRZ	Government of Zambia
IEC	Information, Education and Communication
IRS	Indoor Residual Spraying
M&E	Monitoring & Evaluation
MIS	Malaria Indicator Survey
MoH	Ministry of Health
MSP	Mobile Soak Pits
NMEC	National Malaria Elimination Centre
NMEP	National Malaria Elimination Programme
OR	Operational Research
PMI	U.S. President's Malaria Initiative
PPE	Personal Protective Equipment
PSECA	Pre-Season Environmental Compliance Assessment
SBCC	Social Behavior Change Communication
SEA	Supplemental Environmental Assessment
SOP	Spray Operator
TL	Team Leader
TLA	Team Leader Assistant
TOT	Training of Trainers
TWG	Technical Working Group
USAID	United States Agency for International Development

WHO	World Health Organization
WHOPES	World Health Organization Pesticide Evaluation Scheme
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. 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 additional funding from the UK Department for International Development (DFID) through PMI. 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. During Task Order six (TO6), PMI has been supporting the National Malaria Elimination Center (NMEC) in 36 districts.

Implementation of Zambia's IRS program in 2017 was built upon lessons learned as the country entered its tenth year of PMI support for IRS. AIRS Zambia continued to implement IRS in the same four provinces that were sprayed in 2016: Eastern (9 districts), Luapula (10 districts), Muchinga (7 districts) and Northern (10 districts). All the districts in Northern, Muchinga and Luapula provinces started spraying on October 16th, 2017 except for Mporokoso and Kawambwa districts, which started spraying on October 2nd to accommodate the early rain season. Eastern Province started spraying on 30th October, 2017. The 2017 spray season started later than in previous years in response to the 2016 entomological recommendations to spray as close to the rain season as possible. The start dates for the IRS campaign were staggered mainly due to meteorological trends in the country; rains in northern part of the country start much earlier than in the eastern part. Additionally, staggering the IRS campaign gave the AIRS leadership team the opportunity to maximize their time supervising logistics and spray quality during the campaign. The spray campaign ended on December 16, 2017.

AIRS Zambia trained a total of 2,438 people, of which 35% were women, to deliver IRS in 2017. These included 1,797 Spray Operators (SOPs), 352 Team Leaders (TL), 247 supervisors, and 42 clinicians from 36 districts. Since there were challenges with supervision in 2016, AIRS Zambia identified districts that needed an extra layer of supervision and, as a result, seven seasonal District Coordinators were trained and hired to support the full time staff in supervision of the IRS campaign. The hiring of seasonal district coordinators improved implementation because without them, there were going to be challenges since the DCs who had initially been recruited had left the project. Other local temporary staff were also recruited and trained before the start of the campaign. Logistics and environmental compliance assessments were carried out to ensure that the standard operating procedures and PMI Best Management Practices (BMP) were followed. Stakeholder, partner planning, and community sensitization meetings were also held in order to create awareness and effective involvement of all stakeholders for successful spray operations.

A total of 648,800 structures were targeted to be sprayed in the four provinces, protecting an expected population of 2,626,718. By the end of IRS operations, after 66 days of the campaign, SOPs sprayed 634,371structures out of a total of 684,635 structures found, yielding an overall spray coverage of 93%. A total of 3,005,676 people were protected by IRS, including 77,206 (2.6%) pregnant women and 443,140(14.7%) children under five years old. Table 1 summarizes the results of the 2017 IRS campaign.

TABLE 1: 2017 IRS CAMPAIGN SUMMARY RESULTS

Insecticide Used	Organophosphates (Actellic 300 CS)
Number of provinces covered by PMI-supported IRS	4 (Eastern, Northern, Muchinga and Luapula)
Number of districts covered by PMI-supported IRS	36
Number of structures found by SOPs	684,635
Number of structures sprayed by PMI-supported IRS	634,371
2017 spray coverage	93%
Population protected by PMI-supported IRS	Total Population: 3,005,676 Children under 5: 443,140 Pregnant women: 77,206
Dates of PMI-supported IRS campaign	October 2 – December 16, 2017
Length of campaign (total days)	66 days
Number of people trained with U.S. Government funds to deliver IRS	2,438

The AIRS Zambia team experienced challenges during the spray campaign, such as a large number of refusals in urban areas and inadequate supervision in particular districts, which led to data fraud and chemical pilferage. The other big challenge in this campaign was ensuring proper coordination during the initial implementation of the Operational Research (OR) study utilizing mSpray in six districts in Eastern Province. Target IRS areas for the study were finalized during the first week of the campaign, which led to difficulties with mobilization taking place simultaneously with the beginning of the spray campaign.

1. Country Background

IRS was conducted in Zambia in the Copperbelt beginning in the 1930's. By the 1980's, IRS in Zambia had ceased and was not re-launched until 2003. Zambia began conducting IRS with United States Agency for International Development (USAID) funding in 2006 under the Health Services and Systems Program and (President's Malaria Initiative) PMI started supporting IRS in Zambia in 2008. In 2011, it was recognized that the highest malaria burden occurred in the north-eastern half of the country and prompted a shift to implement IRS in 20 districts in this area. As resources for malaria vector control declined, the country switched to targeted spraying in 2014 to prioritize coverage of high risk areas, in line with Zambia's 2011-2016 National Malaria Strategic Plan.

In 2017, PMI, AIRS Zambia and the Zambia Ministry of Health (MoH) agreed to continue conducting IRS in 36 high-burden malaria districts in four provinces: Eastern (9 out of 9 districts), Luapula (10 out of 11 districts), Muchinga (7 out of 7 districts), and Northern (10 out of 10 districts) targeting a total of 648,800 structures. The number of structures targeted did not constitute all the eligible structures in the district; targeting was based on spraying all eligible structures in selected catchment areas in the districts. . From October 2 – December 16, 2017 a total of 634,371 structures were sprayed out of 684,635 structures found in the 36 districts, using a long-acting organophosphate insecticide (Actellic 300 CS).

Working in collaboration with the MoH, AIRS Zambia was tasked to achieve at least 85 percent spray coverage of all eligible structures in the IRS target areas. In addition, AIRS Zambia provided technical support in the following activities:

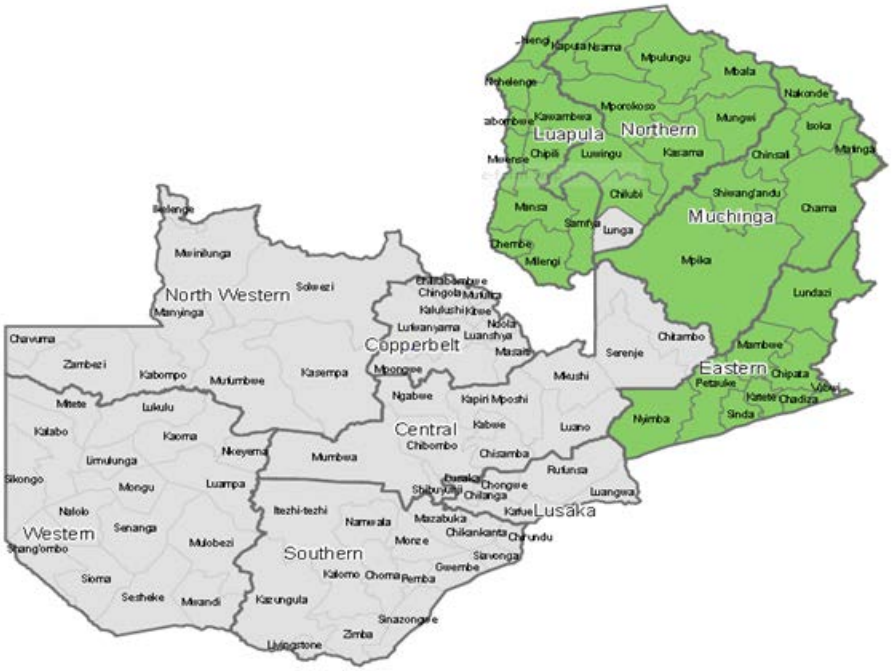
- Training, capacity building, and advocacy at the national and district level as a means of achieving IRS sustainability. This included building the capacity of government officials and partners to undertake high-quality IRS.
- Daily monitoring of the IRS program via supervision of data collection and data entry using the AIRS Access database and the monitoring and evaluation (M&E) supervisory tools, plus the mSpray platform developed by Akros, which was used in six districts in Eastern Province. AIRS Zambia also implemented the Daily Observation of Spray (DOS) to supervise the quality of IRS.
- 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.
- Entomological surveillance including assessing malaria vector density and species composition in intervention areas; establish vector feeding time and location; monitor the quality of insecticide application and insecticide decay rates, and assess vector susceptibility to multiple insecticides.
- Maintenance of the entomological laboratory to ensure that all necessary studies can be carried out throughout the year.
- Provision of high level supervision and monitoring of IRS activities during implementation. Collaboration with Akros to implement an OR study comparing the effectiveness of IRS using different targeting methodologies.

In the GRZ-supported IRS districts, AIRS Zambia collaborated with the MoH through NMEP to

train Master Trainers. The Master Trainers were then responsible for conducting Training-of-Trainers (ToTs) for both PMI and GRZ supported districts. AIRS Zambia provided IRS training materials, M&E tools, and checklists to all the GRZ-supported districts to ensure quality training, enhanced data capture, and effective supervision. Furthermore, AIRS Zambia provided technical support during the planning cycle to ensure that IRS activities were well planned for and supported NMEP to collect and recycle the empty Actellic bottles.

The following map shows the locations of IRS target provinces and districts (Figure 1).

FIGURE 1: MAP OF ZAMBIA SHOWING AREAS OF PMI-AIRS SUPPORTED IRS IMPLEMENTATION IN GREEN



2. PRE-SEASON ACTIVITIES

2.1 SELECTION OF IRS DISTRICTS AND CATCHMENT AREAS

Thirty-six districts out of 37 in Eastern, Luapula, Muchinga, and Northern provinces were supported for IRS in 2017. The 2017 selection criteria were based on the following:

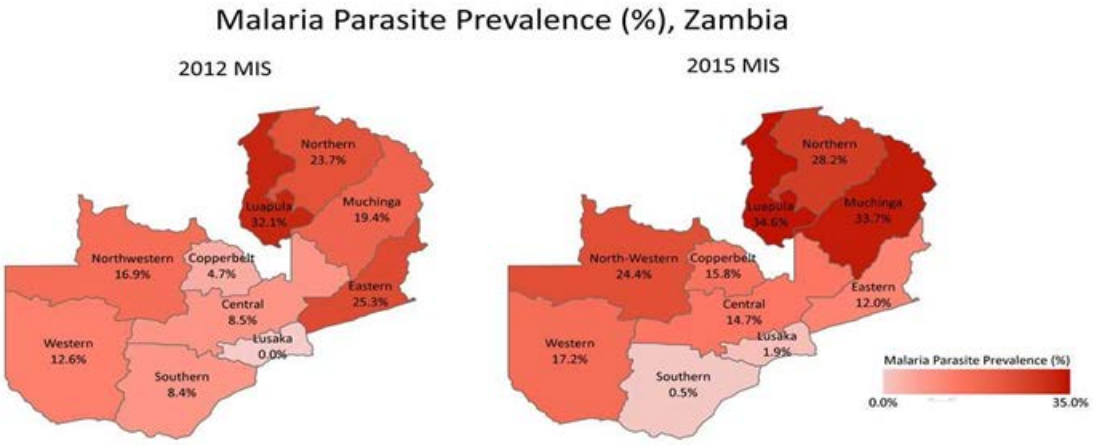
- malaria burden;
- population density;
- structure density;
- available resources;
- accessibility of areas; and
- consideration of universal coverage of ITNs as the primary vector management intervention.

While all the above were considered, the main criteria for inclusion was whether the catchment area had been targeted (using the above criteria) in the 2016 IRS campaign. As in 2016, AIRS Zambia supported the districts to conduct a thorough review of the location of IRS target areas in 2017 to ensure that they were accessible and operationally feasible. For most districts, there were very few modifications to targeted spray areas. However in Luapula Province, some eligible structures that were not targeted during the 2016 spray campaign were included in the 2017 campaign, therefore there were more targeted structures for Luapula was than in previous years.

The map in Figure 2 shows the prevalence of microscopy-confirmed malaria from the Malaria Indicator Surveys (MIS) in 2012 and 2015.

AIRS Zambia project operates in 4 provinces, 35 districts, 389 catchment areas and 4,413 zones. A province is Zambia's largest geographic unit, followed by districts, then catchment areas, and finally zones, which comprise at least one village.

FIGURE 2: MAP OF ZAMBIA SHOWING MALARIA PREVALENCE, 2012 - 2015



The AIRS Zambia team held district-level micro-planning meetings to support them with the selection of catchment areas in Eastern, Luapula, Muchinga, and Northern provinces. Each district listed the number of structures, population, and by malaria incidence per catchment area. In collaboration with the National Malaria Elimination Programme (NMEP), the provincial health offices, and district health teams, the AIRS Zambia team decided that the same catchment areas that were targeted in 2016 should be targeted again in 2017 and that all eligible structures within the targeted catchment areas in Luapula Province that were targeted in 2016 were to be sprayed in 2017.

In total AIRS Zambia planned to conduct IRS in 389 out of 676 catchment areas across the four target provinces, representing an estimated 58% of all catchment areas in the four target provinces. The other 42% of the catchment areas were targeted for spraying by GRZ. Table 2 shows the number of catchment areas and individual structures targeted for IRS in the four provinces. Annex 4 provides a detailed breakdown of structures in each district and catchment area.

TABLE 2: NUMBER OF TARGETED STRUCTURES FOR IRS IN 2017 BY PROVINCE

Province	Number of Catchment Areas in the Province	Catchment Areas conducting IRS (% of total)	Total Number of Eligible structures	Number of AIRS Targeted Structures (% of total eligible strucutres)
Eastern	267	153 (57%)	444,637	223,361 (50%)
Luapula	109	62 (57%)	272,686	217,903 (80%)
Northern	143	95 (66%)	278,997	131,037 (47%)
Muchinga	157	79 (50%)	151,233	76,499 (51%)
Total	**676**	**389 (58%)**	**1,147,553**	**648,800 (57%)**

AIRS Zambia collaborated with Akros to implement an OR study with the main objective of providing the Zambia MoH, NMEC, and the broader malaria community with information regarding how to allocate IRS in the presence of finite resources, and in the context of universal LLIN coverage. The OR study was implemented in six selected districts in Eastern Province (insert 6 district names). Catchment areas within the districts were selected based upon the study criteria for each study arm the districts were assigned as a result, there were new catchment areas that were included in the OR study target area in 2017 that had not been sprayed in 2016.

2.2 District Planning Meetings

Four micro-planning meetings with provincial and district authorities were held in each province from May 18th to 31stin Chipata (Eastern province), Mpika (Muchinga province), Kasama (Northern Province) and Mansa (Luapula province). The two-day planning meetings were organized to discuss and develop IRS operational plans with district teams. Issues discussed during the micro-planning meetings included:

- Timing of spray operations
- The requirement to target 100% of eligible structures in each catchment area
- Spray campaign duration (# of days)
- Insecticide selection
- Procurement and logistics
- Spray performance targets
- Monitoring and supervision plan

- Recruitment of spray operators
- Commencement date for spray operations
- Role and responsibilities of stakeholders before, during, and after spray operations

2.3 Insecticide Selection

Zambia has a rigorous insecticide resistance management structure that supports entomological studies on which insecticide selection is based. The Insecticide Resistance Technical Advisory Committee, which meets annually, determined that an organophosphate, pirimiphos-methyl (Actellic 300 CS) was to be used nationally during the 2017 IRS campaign. The Insecticide Resistance Technical Advisory Committee that comprises representatives from the Tropical Diseases Research Centre, the Macha Malaria Institute, University of Liverpool, Johns Hopkins University, CDC, AIRS Zambia, PMI and the NMEP reviews the entomological studies that are carried out and makes recommendations to the Insecticide Resistance Management Technical Working Group (TWG) that selects the insecticide of choice. The selection of the insecticide included review of data obtained from insecticide susceptibility assays and evaluations of the residual effect of insecticides that were carried out in 2016 and 2017. The Insecticide Resistance Management Technical Working Group (TWG) meets quarterly and reviews all the insecticide resistance data from all the partners. However, the group only met twice in 2017 and plans to meet only once yearly thereafter.

2.4 Logistics Needs and Procurement

For efficiency and effectiveness in conducting logistics assessments, AIRS Zambia organized three teams to be responsible for providing technical support to the districts during the logistics assessment for the 2017 IRS season. The logistics assessment team comprised at least one District Coordinator (DC), Logistics Manager, Chief Environmental Health Officer (CHEO) from the respective province, and an experienced Public Health Officer from the chosen district. The process involved discussions with the District Commissioners, who are the political heads in the districts and district health officials (District Health Director, Planning Officer, Malaria Focal Person, and IRS Manager). In order to standardize the collection of data in the field, AIRS developed an assessment checklist.

The following activities were carried out by AIRS Zambia technical staff:

- Held meetings with the district health office teams to discuss district readiness for the IRS campaign;
- Reviewed previous IRS coverage;
- Reviewed the district plans to ensure the inclusion of all IRS activities and the costs that go along with the activities;
- Assisted districts in strategizing how to identify potential partners and engage all stakeholders in IRS activities; and
- Quantified and procured the IRS commodities required for 2017 spray season.

2.5 Procurement

Procurement for commodities was divided into international and local procurements. All items that were available in Zambia were procured locally, which ensured cost effectiveness and timely delivery. In total, the project procured 162,156 bottles of Actellic for the 2017 spray operations. All 162,156 bottles were received on 18th September 2017.

A consignment of personal protective equipment (PPE), including 6,403 gloves, 182 hard hats, 69,444 nose masks was received in September. A total of 340 Goizper pumps were ordered and they were received in two batches. The first shipment had 272 pumps and the second shipment delivered 68 pumps. AIRS Zambia also received 1,000 constant flow valves (CFV), 1,000 seals (16.5mmx9mmx2mm) and 500 ceramic yellow nozzle tips in September 2017. Various entomology

materials were also procured through the Home Office for the 2017 spraying period. Overalls, socks, mutton cloth, printing of M&E data entry forms and transport services were procured locally through open national competitive bidding process. All the tenders were evaluated by the AIRS procurement committee.

The tables in Annex 1 list the commodities that were procured internationally and locally. International procurements were based on the number of SOPs for 2017 campaign and the balance brought forward from the 2016 spray campaign. All insecticides for the 2017 spray campaign were received and stored at Central Medical Stores Limited while the PPE was stored at the NMEC in Lusaka. AIRS Zambia used NMEP and the AIRS trucks to distribute the IRS commodities before the start of the IRS campaign.

2.6 HUMAN RESOURCES

In order to achieve the objective of spraying at least 85% of the targeted structures as well as ensure good quality spraying, the field-level human resources were organized as follows and are summarized in Table 3:

- One (1) TL supervises five (5) SOPs, the six of whom comprise a team;
- One (1) supervisor is charged with managing two (2) teams; and
- All the supervisors reported to the IRS Manager, who was assisted by the PMI AIRS DC.

At the district level, human resource requirements consisted of two categories:

- Full-time staff: 23 DCs, 36 IRS Managers and 247 Supervisors
- Seasonal workers included the following: 7 Assistant DCs, 71 M&E Assistants, 52 Data Entry Clerks (DECs), 352 TLs, 90 Team Leader Assistants (TLAs, in mSpray districts only),1,797 SOPs, 90 Store Keepers, and Washers.

IRS managers, supervisors, and one of the two storekeepers in a given district were Government of Zambia (GRZ) employees, while the other storekeeper was hired as a seasonal worker employed by AIRS Zambia. An additional seven (7) assistant DCs were hired on a seasonal basis for selected challenging districts in Luapula, Northern, and Muchinga provinces. In addition, AIRS Zambia engaged Neighborhood Health Committee members, Community Health Volunteers, and literate community members to carry out house-to-house mobilization activities (Table 3).

TABLE 3: NUMBER OF PERSONS HIRED BY AIRS FOR 2017 IRS CAMPAIGN

Categories of Persons Hired	Number of staff hired to Support IRS				Total (% Female)
	Spray Ops		Data Capture		
	M	F	M	F	
Spray Operators	1,149	648			1797 (36%)
Team Leaders	227	125			352 (36%)
Team Leader Assistants			65	25	90 (28%)
Data Entry Clerks			30	22	52 (42%)
M&E Assistants			57	14	71 (20%0
TOTAL M/F	1,376	773	152	61	2362 (35%)
TOTAL	**2,149**		**213**		

2.7 IRS TRAINING

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 personnel involved in IRS is done by AIRS Zambia in collaboration with the District Health Offices (DHO) and is conducted annually before the commencement of spray operations. These trainings provide specific skills to seasonal personnel involved in the IRS campaign so that they are able to spray structures correctly. Table 4 below lists each type of IRS training conducted, a description, and the duration. Table 5 lists the number of people trained disaggregated by gender.

TABLE 4: TYPE, DESCRIPTION, AND DURATION OF TRAININGS

Type of Training	Description of Training	Duration of Training
Training of Trainers and Supervisors (TOT)	Participants included IRS trainers and supervisors at the provincial and district level. The training was designed to train individuals who would train seasonal workers (SOPs, store keepers and community mobilizers). The emphasis was to ensure that trainers are able to effectively explain and demonstrate current IRS best practices. The supervision component was also emphasized to improve supervision.	5 days
Spray Operators (SOPs)	AIRS Zambia worked with the DHO to recruit and train SOPs in all of the 36 target districts. The training was designed to build SOPs' capacity to conduct IRS and communicate with households effectively. An emphasis was placed on ensuring that SOPs found all structures and they conduct quality spraying. Other topics covered: introduction to malaria control, spray techniques, handling and managing insecticides and spray pumps, personal and environmental safety, leading a spraying team, data collection and filling out data collection forms, and basics of IEC for IRS.	6 days
Team Leaders	Team Leaders were recruited by the DHOs in collaboration with AIRS Zambia. The training was designed to build the capacity and skills of spray team leaders to lead a team of at least 5 SOPs ensuring that spraying is completed on schedule and delivered with a high degree of quality. TLs were also trained in spraying for 6 days and had 2 days of additional team leader training.	2 days
Data Collection	Data Entry Clerks, Team Leader Assistants and M&E Assistants were trained on the following 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 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.	3 days
Logistics	At least two storekeepers from each target district (one was a Government employee and the other one was an AIRS seasonal store keeper) were trained on store and inventory management.	2 days
Clinicians	Clinicians were recruited from at least one key health facility from each target district. The training focused on insecticide poisoning management, poisoning prevention and mitigation practices, health hazards and their management.	1 day
Community Mobilizers	Community health workers were trained how to increase the community's understanding of malaria, acceptance for IRS, and awareness of IRS spray schedule.	2 day

Type of Training	Description of Training	Duration of Training
Drivers	Newly hired drivers certified to drive for the 2017 IRS spray season were provided with an overview of the importance of safely transporting materials and people for IRS.	1 day
Procurement	The Procurement Policy was made available for use to DCs. The Procurement Policy is intended to guide the District Coordinators in their day to day procurement of goods and services in line with the Abt Procurement Policy and USAID regulations. This is to ensure strict adherence to all procurement procedures. The Districts Coordinators were trained in the use of the Procurement Policy guidelines to ensure that procurement functions were carried out correctly at the district level.	1 day
Gender Sensitivity	All AIRS technical staff and District Coordinators received training in gender issues and the importance of having more women recruited during 2017 spraying season. Moreover all the supervisors were oriented in the component during the 2017 TOT training.	1 day

TABLE 5: NUMBER AND TYPE OF SEASONAL TRAININGS, BY GENDER

Categories of Persons Trained	Training on IRS Delivery														Total (% Female)	
	Training of Trainers		Spray Operations		Data Capture		Mobilization		Logistics Training		Poison Control/ Adverse Events		Supervision			
	M	F	M	F	M	F	M	F	M	F	M	F	M	F		
Supervisors													188	59	247 (24%)	
Master Trainers	14	1													15 (7%)	
Mobilizers							3,774	1,794							5568 (32%)	
Spray Operators			1,149	648											1797 (36%)	
Team Leaders			227	125											352 (36%)	
Team Leader Assistants					76	28									104 (27%)	
Data Entry Clerks					36	28									64 (44%)	
M&E Assistants					59	14									73 (19%)	
District storekeepers									70	20					90 (22%)	
Clinicians											29	13			42 (31%)	
TOTAL M/F	14	1	1,376	773	171	70	3,774	1,794	70	20	29	13	188	59	5,622	2,730
TOTAL/Training	**15**		**2,149**		**241**		**5,568**		**90**		**42**		**247**		**8352 (33%)**	

3. GENDER MAINSTREAMING

As part of the Project gender strategy, AIRS Zambia implemented several activities to promote gender mainstreaming across its activities. To ensure that all program activities align with USAID's policy on Gender Equality and Female Empowerment, AIRS Zambia included modules on gender in all of the trainings that were conducted. To emphasis its importance at the district level, all IRS Managers and Supervisors were taken through an orientation in gender awareness and integration during the microplanning to ensure they can take the lead in addressing gender issues. After these presentations, it was clear that most participants appreciated the idea of integrating more women in the spray teams to increase women's participation in IRS.

AIRS Zambia also worked with the NMEP to develop Information, Education, and Communication (IEC) materials which had pictures depicting women spraying. This was in an effort to ensure that more women were motivated to join the IRS program. Anecdotal data suggests that these inclusive images were important to female SOPs in their decision to apply for positions on the campaign. Therefore, AIRS Zambia will continue to use these pictures in the future to recruit more women.

Several PMI/AIRS countries have found that distribution of sanitary pads to female workers supports optimal attendance. AIRS Zambia distributed sanitary pads to female SOPs in all four provinces during the 2017 spray season. Undocumented reports from seasonal workers suggest that these supplies were appreciated and allowed more women to consistently come to work. In addition to providing sanitary pads, the project ensured that sanitary bins were located in washrooms to promote hygienic disposal. Zambian labor law allows women a day off from work per month while menstruating. This is commonly referred to in Zambia as "mother's day" and AIRS Zambia increased its communication efforts this year to ensure that all seasonal workers were aware of this benefit and supervisors understood that these absences were paid. During the spray campaign, there was one reported case of sexual harassment in Nchelenge involving a male head of household and a female spray operator. Fortunately the spray operator was not physically harmed as the attempt was thwarted by alert supervisors. The culprit was apprehended by police and the spray operator was allowed to take time off. Once she felt comfortable, she was given a different position as she requested.

AIRS Zambia has always advocated for increased women participation in IRS activities at all levels. In the 2017 IRS season, AIRS Zambia recorded an increase in the number of women who were trained and hired by the program to support IRS. In total 834 females were hired as SOPs, TLs, DECs, TLAs and M&E Assistants in 2017 representing about 35% of the total personnel hired. While the team implemented actions to increase the number of women SOPs, there was only a modest increase in numbers from 33% in 2016 to 35% in 2017. Even though the percentage didn't increase substantially, there were other improvements and gains in this area. According to the study by AIRS Zambia on the assessment of the effect of increased women participation on IRS operations, it was clear that there was meaningful correlation between increase women participation in IRS operations and increase in the level of IRS spray quality. Moreover, the Zambian communities usually accepts women and therefore this is likely result in increased IRS acceptability by the community. The project will continue dialogue with the NMEP and other stakeholders to support additional progress towards equitable employment of women and men in IRS for future campaigns.

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, drama performances, radio announcements and the public address system. The engagement of beneficiaries, stakeholders and partners ensured open discussions that reached many people of different target groups and was aimed at improving acceptance. The IEC strategy was heavily strengthened in the large urbanized districts and therefore IRS acceptance improved in most urban districts. For example in Kasama and Mansa, the spray coverage was 60% and 77% in week three and week six, respectively. After extensive, IEC efforts, the coverage improved to 94% and 87% respectively, at the end of the spray campaign. In addition to implementation challenges in urban areas, IEC efforts had to be adaptable in the OR study areas due to varied and delayed designation of target areas. This is explained in detail under section 5.2.

4.2 Development of Social Behavioral Change Communication (SBCC) Materials

During the previous spray campaigns AIRS Zambia did experience low IRS acceptability rates in some districts particularly in the urban areas despite massive SBCC efforts. In order to address this situation, AIRS Zambia in collaboration with NMEC and partners, developed SBCC materials for use in the 2017 spray season. These included the SBCC strategy for IRS in Zambia, sensitization materials, and mobilization materials. Specific materials developed consisted of the IRS SBCC strategy, posters, frequently asked questions (FAQs), job aids for mobilizers, and talking points for religious and traditional leaders. Overall, these materials had a positive impact on the program. Most mobilizers appreciated the job aids and the traditional/religious leaders were happy that the talking points made it easy for them to communicate the IRS messages.

The main challenge faced by the IRS program in Zambia, was low acceptability of IRS at household level. In the 2017 IRS season, the average rate of refusals represented 38% of all unsprayed structures, as compared to 44% in 2016. During the 2017 IRS season, despite all the districts meeting the 85% spray coverage, higher than average rates of refusal among unsprayed structures were observed in Mansa (46%), Kaputa (52%), Luwingu (49%), Mporokoso (49%) and Mungwi (49%). Table 6 below shows the total number of structures that were found but not sprayed and reasons for not spraying the structures, for both the 2016 and 2017 spray seasons.

TABLE 6: TOTAL UNSPRAYED STRUCTURES AND REASONS FOR NOT SPRAYING

Year	Total # of found structures that were not sprayed	Total % Unsprayed	Sick	Locked	Funeral	No one home	Other reasons	Refused
2016	53,379	9%	14%	20%	2%	9%	12%	44%
2017	50,264	7%	15%	19%	3%	11%	16%	38%

During the 2016 IRS implementation season SOPs sprayed 17,366 (3%) more structures, across the four targeted provinces, than the targeted 542,184 structures as compared to the 2017 season where SOPs sprayed 14,509 (2%) fewer structures than the target of 648,800. The primary reason for spraying a total number of structures that varies from the target, is that district-level records of numbers of structures in each catchment area, which are estimates, are used for planning the IRS campaign and sometimes do not match what is found on the ground during implementation.

4.3 Door-to-Door Mobilization

The main strategy for communicating IRS messages before the 2017 IRS campaign was door-to-door mobilization. Door-to-door mobilization commenced two weeks before the start of the 2017 spray campaign. During the campaign, however, additional houses were mobilized as a result of the OR study in Eastern Province. The program trained and engaged a total of 5,568 mobilizers who resided in the target communities. This enabled them to visit every household with IRS messages, demystifying and correcting any misconceptions about IRS and educating households on their roles and responsibilities before, during, and after their house is sprayed. For the first time, mobilizers were equipped with job aids which enabled them to be more focused and more effective than before. Mobilizers also ensured that community members were informed about the dates for spraying their communities. During the door-to-door mobilization, mobilizers' collected household data on the number of people reached with IRS messages, provided IRS cards to all households that did not already have one from a previous campaign and labeled the wall with 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. Despite massive IEC efforts, one of the challenges encountered was that people sometimes left their houses at the time the spray operators arrived or were unprepared for the visit. Another challenge was that a number of households misplaced cards that were distributed to them during the previous campaign. A similar picture was observed in two of three catchment areas visited during the current 2017 PSDQA exercise whose full results will be reported later. The results of the 2016 PSDQA exercise revealed that only 68% of the households that had been mobilized retained their IRS cards, within the first two months after the spray campaign. In order to improve on the retention of IRS cards, AIRS Zambia piloted zip tags in one district in each of the four provinces, during the 2017 IRS implementation season. Each zip tag consisted of two components; a zip tie and a card. Each zip tag was to be tied to a pole under each household's eaves. The four districts selected under the pilot were Sinda in Eastern Province, Chipili in Luapula Province, Senga in Northern Province and Shiwangandu in Muchinga Province. The pilot districts were each selected because of the small number of targeted structures in the districts and therefore resulted in less cost since the zip ties were very expensive. But if it is proved that zip ties are well retained the overall cost would be lower compared to procuring the IRS cards every year. In total the number of zip tags that were procured for the 4 provinces constituted only 3% of all cards that were procured for the 2017 IRS season. In one catchment area and one zone (Senga and Chipili, respectively) residents cut zip tags off of their houses shortly after the spray campaign. The remaining two districts (Sinda and Shiwangandu) had no problems with zip tags and thus the retention was high. However, the formal rate of retention of these tags will be estimated during the 2018 mobilization efforts.

4.4 Mass Media Communication

The Minister of Health launched the IRS spray campaign on national television and radio. There were three main radio programming initiatives used in the 2017 IRS campaign: radio spots which are also called jingles, radio discussions (interactive shows) and announcements about IRS and its benefits. Radio spots started airing in September, two weeks before the start of spray operations and continued three times per day throughout the spray period. Radio discussions were centered on achieving high 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. Whereas radio spots are a good avenue through which the community are informed of the spray campaign, actual engagement of the community through political and traditional leaders is what made the most impact.

5. IMPLEMENTATION OF IRS ACTIVITIES

IRS implementation was carried out over a 66 day period from October 2 to December 16, 2017. A total of 648,880 structures were targeted to be sprayed in four provinces (Luapula, Northern, Muchinga, and Eastern). The average number of operational days per district was 30 days. The 2017 spray season started later than the 2016 campaign in response to the 2016 recommendations to spray as close to the rainy season as possible. The start dates for the IRS campaign were staggered mainly due to meteorological trends in the country; rains in northern part of the country start much earlier than in the eastern. Therefore, IRS implementation in the northern part of the country started on October 2nd while implementation in the eastern part started on October 30th. Additionally, staggering of the IRS campaign gave the AIRS technical team an opportunity to conduct supervision in the field and oversee the logistics and the quality of spraying during the campaign in a more effective manner. By the end of IRS operations, AIRS Zambia found 684,635 structures. A total of 634,371 structures were sprayed yielding spray coverage of 93%. Provincial level coverage is shown in Table 7. A total of 3,005,676 people were protected by IRS, including 77,206 (2.5%) pregnant women and 443,140 (14.7%) children under 5 years old. Annex 2 outlines the start and end dates of the spray campaign for each district.

TABLE 7: PROVINCIAL NUMBER OF STRUCTURES FOUND AND SPRAYED

Province	Targeted	Found	Sprayed	Spray Coverage
Eastern	223,361	245,640	226,635	92%
Muchinga	76,499	88,093	82,159	93%
Luapula	217,903	215,184	198,803	92%
Northern	131,037	135,718	126,774	93%
Total	**648,880**	**684,635**	**634,371**	**93%**

After a target area has been visited, mop-ups were carried out to spray any structures that were found but were not sprayed during the first visit. Mop-up efforts played an important role in ensuring that 85% of eligible structures in each catchment areas were sprayed during the 2017 spray season. During the 2017 spray season AIRS Zambia introduced mop-up teams for all the districts and therefore mop-up was part of the routine daily activity. AIRS Zambia mopped up immediately after a zone had completed spraying.

5.1 IRS SUPERVISION

To ensure adequate supervision, AIRS Zambia ensured that all levels of supervision were functional in both mSpray and non-mSpray districts. In non-mSpray districts, a team is composed of five SOPs and one TL, while in mSpray districts a team is composed of six SOPs, one TL, and two TLAs. The TLAs are responsible for directing the SOPs which houses to spray using a tablet-based interactive map in the mSpray districts. They also get GPS locations and enter data on smart phones in the software called ODK Collect. DCs were instrumental in strategizing the deployment of SOPs and they coordinated the overall supervision. At the national level, the Chief of Party, the Deputy Chief of Party and the Operations Manager continued providing oversight in the four provinces. Each province had a designated responsible member of the senior management team who was able to make immediate decisions in the field. The Chief of Party was in charge of Northern Province, while the Deputy Chief of Party was in charge of Eastern province, and the Operations Manager was in charge of Muchinga and Luapula provinces. The district teams were comprised of the DC, IRS Manager, Supervisors, M&E Assistants and TLs. In the six mSpray districts however, TLAs were also hired on the team to collect the mSpray data. 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. TLs and other supervisors used the Directly Observing Spraying (DOS) forms to monitor quality of spraying and provide on-the-spot feedback to improve SOP performance. 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. If the team had any difficulties or concerns pertaining to IRS operations that could not be dealt with at the district level, these were communicated to the provincial coordinators immediately.

AIRS Zambia developed and used a monitoring and supervision schedule during the 2017 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. Assistant District Coordinators were trained and were deployed to districts that had been identified in 2016 as needing additional supervisory support during IRS implementation, including Chembe, Chienge, Chipili and Nchelenge districts in Luapula Province, Nsama and Senga districts in Northern Province.

5.2 mSPRAY IMPLEMENTATION

During the 2017 spray season, mSpray was shifted from Luapula Province, where it had been implemented since 2014, to Eastern Province to support the implementation of an OR study. In an mSpray district, a spray team was comprised of one TL, two TLAs and six SOPs making a total of nine spray personnel per spray team. In both mSpray and non mSpray districts, the role of a team leader is to supervise SOPs and ensure quality spraying and data accuracy. The role of TLAs is primarily to guide the team to locate structures and update the database with structure details using detailed maps loaded onto tablets. Each TLA is responsible for guiding and entering mSpray data via tablet for three SOPs.

The OR study used mSpray as a tool for mapping targeted areas and eligible structures and collecting data in six districts in Eastern Province. The study was approved just a few days before the launch of the IRS campaign, which resulted in last-minute changes in the implementation plan in the target districts. Some catchment areas that had initially been targeted for spraying based on the 2016 AIRS campaign, and mobilized as such, were ultimately not-eligible for IRS under the OR study targeting methodology. AIRS Zambia did put in place measures to mitigate the effects of retargeting of some spray areas in the OR study districts including; engagement of chiefs, holding focus group discussions and close supervision of mobilization teams in the retargeted areas. Moreover the mobilization exercise in the retargeted areas was more focalized as mobilization teams were supervised by TLAs who were using tablets to guide the mobilization teams on a daily basis. The negative effect of retargeting was further mitigated by the fact that it took fewer days, typically less than a week, between the time structures were mobilized to the time spray teams visited the structures. Additionally an official letter was obtained from MOH informing the districts of the OR study and AIRS Zambia district officials were able to explain to the communities why their structures were left out even though they were initially included in the plan.

The 2017 IRS results showed that the refusal rate in the OR study target areas was 33% compared to the refusal rate in non-OR study areas that was 41%. However there were some reported instances of dissatisfaction among affected community members and district health officials as a result of targeting methodology under the OR study that left out some target areas that had initially been targeted for spraying in the 2017 IRS season.

5.3 LOGISTICS

5.3.1 IRS STORAGE AND INSECTICIDE STOCK MANAGEMENT

The Logistics Coordinator was in charge of managing stock at the central level and provided overall supervision for the 90 Store Keepers. Each district store was managed by two Storekeepers, one Government employee and one AIRS seasonal Store Keeper. All of the districts had storerooms

where all of the commodities were kept. However, there were a few districts, namely Nchelenge and Mwense, which used storage facilities that belonged to the local authorities (district councils). All IRS commodities were stored according to the standard PMI BMPs for storage of IRS commodities. To enhance tracking of insecticide usage, the IRS Daily Insecticide usage register and Stock Control Cards were used to account for the quantity issued, quantity used, and quantity returned on a daily basis. The document register was also used to account for the number of empty bottles and reveal any possible discrepancy between the number of bottles used and the empty bottles brought by the SOPs. Table 8 below shows the total number of bottles of Actellic 300CS used by each province which include the number of bottles procured by PMI and the bottles contributed by GRZ.

TABLE 8: ACTELLIC CONSUMPTION, BY PROVINCE

Bottles of Insecticides used for the 2017 IRS				
#	**Province**	**Qty procured by PMI**	**Qty contributed by GRZ**	**Total**
1	Muchinga	20,426	312	20,738
2	Luapula	50,989	1,244	52,233
3	Northern	33,542	2,926	36,468
4	Eastern	57,249	2,083	59,332
TOTALS		**162,206**	**6,565**	**168,771**

A total of 168,771 bottles of insecticide were used to spray 634,371 structures with a utilization ratio of approximately 3.8 structures per bottle.

The average number of bottles used by a spray operator per day was 3.3 and each operator, on average, sprayed 13 eligible structures per day among the 36 districts.

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 conducted post-spray inventory activities. All IRS materials and equipment, remaining insecticides, and insecticide-contaminated wastes were returned to the district warehouses. All equipment was checked to see any malfunctioning. Broken equipment was identified and would be repaired before the start of the 2018 IRS campaign. All unsalvageable equipment, like plastic sheets, will be disposed of according to environmental compliance protocols by March 31, 2018. During the 2017 spray season, there were no unused insecticides that had been procured through the AIRS program, and of the 25,059 bottles that GRZ made available to AIRS project, 18,494 unused bottles were returned to GRZ custody. These bottles are marked with a manufacture date of June 2017 and expire two years thereafter, which, in this case, is June 2019. 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 compliance with environmental regulations using disposal facilities available in Zambia by March 31, 2018. Refer to section 8 for details on disposal.

6.2 POST-SPRAY REVIEW MEETINGS

After the IRS campaign, four post spray review meetings are organized and attended by PMI, AIRS, NMEP, and other stakeholders. The all partners' meetings is scheduled to take place the second week of February in the four provincial capitals. During these meetings, attendees will discuss the operations, successes, challenges, lessons learned, and recommendations during the 2017 spray campaign and the way forward for the 2018 campaign.

7. Monitoring and Evaluation

Monitoring and Evaluation (M&E) for the 2017 IRS campaign followed the processes outlined in the 2017 AIRS Zambia Work Plan. The AIRS M&E approach incorporated successful aspects of the M&E system and lessons learned from the 2016 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 2016 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. During the TOT training for IRS Managers and Supervisors, the M&E team reviewed the revised SOP form, Team Leader Form and Daily Observation of Spray Form. The IRS Managers and Supervisors were then able to explain the form 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 activities, AIRS hired M&E assistants and DECs in each of the 36 districts. AIRS Zambia also utilized the Client Technology Center, an Abt Associates internal support department, for the AIRS database, which tracked key performance and output indicators. AIRS technical staff also used the database to generate near "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 gave the forms to the DECs for entry, who then performed a final verification of spray data before updating the database. At the end of each day, the M&E team reviewed the data entry progress for all of the districts and sent an update, in the form of an electronic report, to the central office in Lusaka. The M&E team checked for errors and addressed any issues with the DECs immediately.

The PSDQA exercise that was conducted at the end of the 2016 IRS campaign revealed lower than anticipated performance in spray coverage. This prompted the project to implement measures aimed at improving spray coverage, during the 2017 IRS campaign.

As a result and lessons learned from implementing mSpray in Luapula Province in previous years, the M&E team reviewed the data from the AIRS database on a weekly basis and was able to provide feedback to all the respective target provinces and districts on performance and coverage, highlighting all zones that had not achieved 85% coverage. The report also indicated the number of structures that needed to be revisited through a mop-up campaign in order to attain 85% coverage.

The weekly report was sent to all AIRS technical staff, AIRS district coordinators and GRZ personnel, including the Chief Environmental Health officers, IRS managers, Provincial Health Directors, and District Health Directors.

For quality control purposes and timely generation of the weekly spray progress reports for PMI, all data were expected to be entered within 48 hours of spraying. In some instances, data were not entered or synced within 48 hours for several reasons, including:

- Frequent internet outages by mobile carriers in some districts.
- Issues with remote data syncing: SOPs would sometimes camp overnight when they were spraying in remote areas. In these instances, DECs would either go camping with SOPs and enter data in the field and not sync it until they returned to the base, or they would wait until SOPs returned to the base to enter and sync the data.

Daily SOP Forms were filed at the data centers according to spray date and team number. Spray data was also backed up daily to each computer hard disk and to an external hard drive for additional data safety and storage.

7.3 DIMAGI PLATFORM

AIRS Zambia collaborated with Dimagi to implement the Dimagi platform to ensure quality reporting and supervision in all the 36 target districts. The Dimagi platform focused on the following:

- Daily Reminder Messages: this system was used to send daily SMS reminders (job aids) to SOPs, TLs, Supervisors, DCs and M&E Assistants.
- Data Collection Verification (DCV) forms: this system was used on a daily basis by M&E Assistants to update the database with data collected using DCV forms.
- Performance tracking sheets data: this system was used to update data and send daily reports. The Dimagi platform collected and sent out daily aggregated summary data on spray performance for target provinces and districts.
- Supervisory Checklists: this system was used to update and send out daily supervisory checklist reports.

7.4 MSPRAY IMPLEMENTATION

AIRS Zambia, in partnership with Akros, used mobile devices for data collection and management (mSpray) in six districts in Eastern province (Nyimba, Katete, Chadiza, Vubwi, Mambwe, and Lundazi). This was the first time that mSpray was being used in Eastern province. During the previous two years of IRS implementation, mSpray was implemented in 7 districts in Luapula province. Implementation of mSpray in Eastern Province was prompted by an OR study, designed and implemented by Akros in collaboration with NMEP PMI and AIRS Zambia.

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 are key features of the mSpray tool for data collection and management:

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

7.5 DATA QUALITY ASSURANCE AND CONTROL

During the 2017 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 were used 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 M&E Assistants, IRS managers, supervisors, district coordinators as well as AIRS senior staff visiting the districts.
- Data Collection Verification forms were used to check 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 SOP Forms matched the information reported by households.

7.6 Physical Data Verification

Physical data verification was performed at three different levels:

- Team Leader Level: 100% of spray data collected on SOP forms was reviewed and the math was verified.
- District Level: each supervisor had to review five sprayed structures per week in their district while DCs had to review 20 sprayed structures in their districts.
- Staff from AIRS and the NMEP central level performed random data verification as part of routine monitoring visits across the 36 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.

7.7 Database Quality Control

AIRS Zambia used the Microsoft Access database, which includes pre-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 within 48 hours from the time structures were sprayed, in the following ways: 1) by spray "Totals" or a summary of each Daily SOP Form in order to produce "real-time" reporting of spray progress (24 hours), and 2) by spray "Details" data (line-by-line or structure-by-structure) for more accurate data entry and high quality data (48 hours). By using the IRS Reporter, DECs investigated and reconciled discrepancies between spray "Totals" and "Details" data for a final dataset with the campaign results. Corrections were made to the paper spray forms and the database, where necessary.

7.8 Random Spot Checks

The M&E team performed daily data verification activities of the Microsoft 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 random field checks by visiting target areas that had been sprayed within the past three (3) days to interview households. This enabled PMI AIRS to validate spray data or, in the case of Mpulungu District, expose instances where SOPs had falsified data. The main quality control issue that was uncovered in Mpulungu District was the data falsification by 36 SOPs and insecticide theft by one SOP and one TL. This incident was uncovered through the use of a supervisory tool designed to catch reporting errors (the DCV tool), which was found to be misaligned with the M&E assistants' findings on the ground. .. After verification, 36 SOPs were found to be falsifying spray data with the intention of increasing daily spray coverages on the SOP data collection form. Moreover, one SOP and one TL were also found guilty of colluding with the household owners to divert insecticide meant for IRS in exchange for money. As a corrective measure, all the affected SOPs were dismissed with immediate effect and will not be engaged in any

future PMI IRS activities in Zambia. The spray campaign was suspended in the districts immediately after the incidence was discovered in order to rectify the problem. A thorough audit of the affected target areas, in the district, was conducted within 10 days following the incidence. The spray campaign was only resumed after the spray teams from two other target districts (Mbala and Kasama) were able to travel to Mpulungu to ensure that all structures falsely documented were sprayed and properly documented.

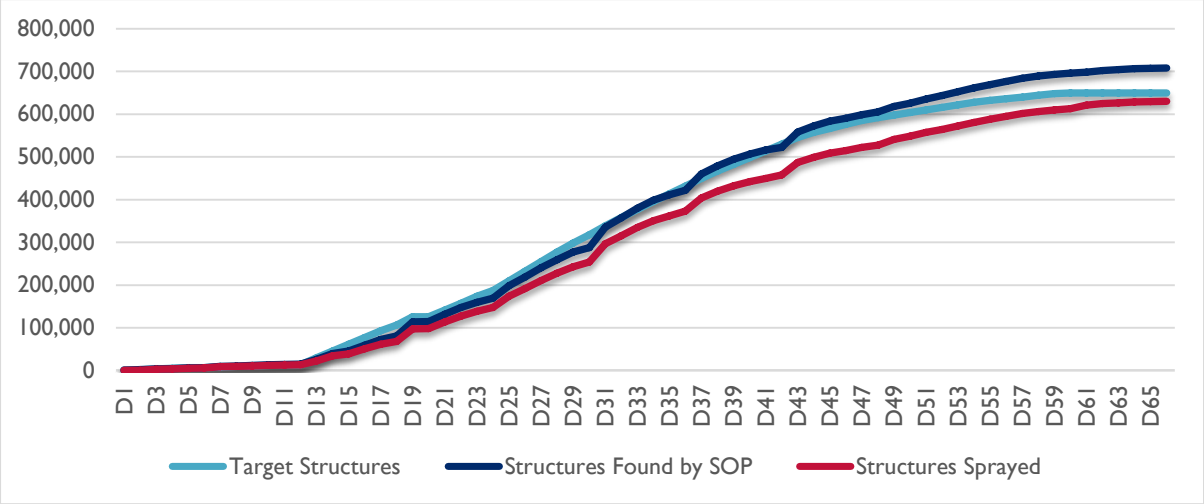
7.9 Post Spray Data Quality Audit (PSDQA)

During the 2016 spray season, the post spray data audit (PSDQA) results reviewed that the overall spray coverage (91%) reported by the districts did not fall within the 95% confidence interval (79.6% to 85.3%). As a result of the lower than expected coverage findings, another PSDQA was conducted following the 2017 spray season to ensure that the recommendations to improve the data quality were effective. The 2017 PSDQA data collection exercise was scheduled to take place within 60 days after completion of the 2017 IRS implementation exercise and this was completed within the 60 day timeframe. The PSDQA commenced on February 12, 2018 and was completed on February 16, 2018. The PSDQA report to PMI is due 90 days after the completion of the campaign.

7.10 IRS Results

During the 2017 IRS implementation, PMI AIRS monitored the structures that were found and sprayed and compared this to the target structures on a weekly basis. Figure 3 shows found and sprayed structures relative to the targeted structures over a period of 66 days.

FIGURE 3: IRS DAILY PERFORMANCE TRACKER



8. ENVIRONMENTAL COMPLIANCE

This section 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 (GRZ) Environmental Regulations: Zambia Environmental Management Act (EMA) cap 204, No 12 of 2011; and
- The 2015 Supplemental Environmental Assessment and its 2017 amendment – including the Pesticide Evaluation Report and Safer Use Action Plan (PERSUAP).

This section also contains some of the operational issues that came up during IRS implementation and how the team responded. More details can be found in Annex 3 – the Environmental Mitigation and Monitoring Report (EMMR).

In accordance with 22 CFR 216, AIRS Zambia operates under a Supplemental Environmental Assessment (SEA) that was approved in September 2015 and was amended in 2017 to include clothianidin. The SEA and its 2017 amendment authorizes the use of all four classes of insecticides recommended by the World Health Organization Pesticide Evaluation Scheme (WHOPES) (pyrethroids, carbamates, organophosphates, and organochlorine) as well as chlorfenapyr and clothianidin when listed on the WHO pre-qualified insecticide list. It is valid for IRS nationwide during the period of September 2015 to September 2020.

8.1 ENVIRONMENTAL DOCUMENTATION

The 2015 SEA for Zambia stipulates that PMI AIRS Zambia is required to submit an annual Letter Report to PMI two months prior to the beginning of spraying. However, since the initial SEA was amended in 2017, a Letter Report covering the October – December 2017 spray campaign was then not required.

8.2 PRE-SEASON ENVIRONMENTAL COMPLIANCE ASSESSMENT (PSECA)

In May 2017, the Environmental Compliance Officer (ECO) and/or Assistant ECO travelled to all the district IRS operations sites in order to ascertain the preparedness of the IRS facilities such as warehouses, soak pits, shower rooms, pit latrines, wash bays, etc. PSECA tool imbedded on smart phones was used to assess, among other things:

- The soak pits' capacity to filter traces of pesticides from rinse water during end of day clean up.
- Warehouse capacity to store and handle pesticides and other IRS supplies.

Work lists produced from the assessments detailed environmental compliance findings at each IRS operations site, and the Environmental Compliance (EC) team developed an implementation plan to address any deficiencies. The implementation plan delineated the roles and responsibilities of respective individuals from both AIRS and MoH in addressing the findings. The refurbishment process commenced after the plan was approved.

In all, two (2) new soak pits were constructed and nine (9) existing ones were renovated. Since the number of SOPs in some districts increased drastically, wash bays had to be expanded at some operations sites to create enough space to accommodate two sets of rinse barrels to streamline end of day cleanup. In some districts, when the distance between the primary soak pit and the spray site was too far, mobile soak pits (MSP) were used. A total of 35 MSP were constructed in order to facilitate end of day cleanup in these distant spray areas.

8.3 New Spray Areas/ Operational Sites/ Major Renovations

In 2017, AIRS Zambia continued dividing large districts to make operations manageable, namely, two large target areas in Eastern Province, Chipata Boma and Lundazi District, which were each divided into two operations sites. In total, two new operations sites (warehouse, soak pit, shower/change rooms, pit latrines, and wash bays) were set up at Kasenengwa and Kanyanga Rural Health Centers in Chipata and Lundazi districts, respectively. Other major renovations included: storage facility renovations in Chadiza, Samfya and Vubwi districts; soak pit renovations in Chembe, Mansa, Mwense, Nchelenge, Mungwi, Chilubi, Katete, Senga and Kaputa districts; fencing of the IRS operations site in Samfya at Mwewa, as well as the installation of water distribution systems at Mkanda IRS operations site in Chipata District. In all cases, the work was performed under the full supervision of the DCs, MoH district representatives and given final approval by the in-country ECO.

8.4 Follow-up Environmental Compliance Inspections

After addressing all the EC deficiencies identified during the initial PSECAs, two weeks prior to the launch of the spray campaign, the ECO and/or Assistant ECO revisited all IRS bases to confirm that the refurbishments were completed according to the plan and ascertain the district's preparedness for the 2017 IRS campaign. 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.

8.5 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 BMPs to ensure compliance with safety and environmental requirements. A total of 90 vehicles (trucks) were hired through this process and 120 drivers were trained in Kasama, Mansa, Mpika, and Chipata districts a few weeks before the commencement of the spray campaign. During the inspection, transporters were advised to retrofit the trucks with benches, tents, and railings and to ensure that all the trucks were roadworthy. All selected vehicles were equipped with Spill Management and First Aid kits, Material Safety Data Sheets, and Accident/Emergency response procedures.

8.6 Medical Clearances

All the SOPs hired for the 2017 spray season underwent medical examinations to determine physical fitness for the program's demands. Additionally, all female SOPs were given a pregnancy testing before the IRS campaign to ensure no expecting mothers were at risk of exposure to insecticide. The test was repeated on the 30th spray day for all districts that sprayed for more than 30 days. There were no positive pregnancy tests recorded throughout the campaign. The medical tests conducted included: pregnancy test (for women), physical examination, full blood count and blood pressure.

8.7 Management of Insecticide Adverse Effects

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. A total of 42 participants (at least one participant from each district, two from the large districts) attended the training. To prepare for any unforeseen incidents such as insecticide poisoning, an antidote for insecticide poisoning (atropine) was readily available in all district hospitals as well as central medical stores.

8.8 Mid-spray Environmental Compliance Inspections

The 2017 IRS monitoring and supervision was conducted by AIRS staff in close collaboration with the MoH employees in the respective districts using EC tools embedded on smartphones. A total of 95 smartphones that were procured in 2015 were used to facilitate electronic submission of all mid

spray inspection reports. Other MoH employees, who did not have smart phones, were encouraged to use paper based monitoring and supervisory checklists when administering mid-spray inspections. The paper based reports were to be reviewed by the ECO and the DCs once every week.

8.9 Morning Mobilization

In order to ensure that SOPs' safety was upheld, the ECO, Team Leaders and IRS supervisors carried out random physical inspections during morning mobilization to check for any SOPs who might have been experiencing illness such as difficulty breathing, fatigue, weakness, intoxication, etc. During morning mobilization, SOPs began the day by reporting to a restaurant to have a meal. This reduced the frequency of SOPs having meals in PPE, which had been reported in previous campaigns. Any time an anomaly was reported, corrective measures were put in place and a meeting was convened with the spray teams to provide guidance on best practices. As a result, there were no recurring non-compliant issues except for a repeated observation of SOPs who had not donned full PPE before boarding the truck.

8.10 Homeowner Preparations and SOP Performance

Homeowner inspections were performed while SOPs were in the field conducting IRS. During this inspection, homeowners were interviewed to assess whether they received adequate information on their responsibilities after receiving IRS. Out of the 1,128 homeowner preparation and spray operator performance inspection reports submitted, below are some of the issues that were flagged and immediately resolved with training, when possible:

- In 157 instances residents, especially in urban areas, refused IRS because they claimed they were not fully informed about IRS, that not all mosquitoes died after the last spray season, or that there was an increase in population of other pests (e.g. bed bugs) after the last IRS campaign;
- In 7 instances SOPs were reported not to be spraying all the recommended surfaces, especially the eaves;
- In 35 instances SOPs were observed not to be spraying at the correct speed and could not maintain a 5cm overlap between each swath;
- In 14 instances SOPs were observed to be spraying wrong surfaces, especially curtains; and
- In 169 instances SOPs were observed not to be in full PPE. In 166 instances out of the 169, SOPs did not have flashlights.

All the above 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.

8.11 Storekeeper Performance Inspections

In 2017 PMI AIRS Zambia fully sponsored 45 seasonal storekeepers who each worked in close collaboration with the district medical office storekeeper in respective districts which brought the total number of storekeepers to 90. The fact that most of the store keepers were not new in the program but had previously been engaged in the IRS campaign, made it easier for them to adhere to the PMI BMP guidelines. Additionally, because all AIRS employees were in the field to monitor and supervise IRS operations, a number of non-compliant issues were rectified immediately, corrective measures were implemented, and no critical non-compliant issues were recurrent. Some of the minor discrepancies that were observed in stock management were mostly in the first few weeks 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 continued, all the storekeepers improved their performance and, by the end of the campaign, no non-compliant issues were recorded.

8.12 End-of-day Cleanup Inspections

The end of day cleanup inspection was conducted at the IRS operations site and the camping sites where mobile soak pits were in use during end of day clean ups. It was observed that the wash area at the Lundazi Boma operations site had developed cracks during IRS implementation and allowed the rinse water to seep through to the ground. This problem was rectified immediately and the wash bay began properly draining the rinse water into the soak pit.

In general, during the 2017 IRS campaign, there was a drastic reduction with regard to non-compliant issues during end of day cleanups as compared to previous spray seasons.

8.13 Incidents

During the 2017 spray campaign, there were five incidents that were reported in Chipili, Mbala, Mpulungu, Nchelenge, and Lundazi districts. The five incidents were recorded and reported to PMI within 48 hours, as per the PMI incident report requirement. The details of the incidents reported include the following:

- A road traffic accident occurred in Chipili District where a motorbike flipped over when the IRS manager was en-route to Mutipula catchment area for IRS community mobilization. This was after he had encountered a snake ahead of him and therefore applied the emergency brakes, causing the motorbike to flip over. He sustained injuries on the right leg and was rushed to Mansa general Hospital where it was diagnosed by the clinician that he suffered a fracture of the left fibula at distal third, and fracture of 5th metacarpal on the right. The injured was then put on bed rest after the affected leg was put in a cast. As a corrective measure an emphasis was given to all motorcyclists to reduce the speed during IRS monitoring and supervision.
- Another road traffic accident occurred in Mbala District involving 10 SOPs and one supervisor (EHT) who were coming from the field en-route to the IRS operations site. At approximately 5 km from Kalambo village, the driver of the GRZ Toyota Land Cruiser registration number GRZ633BX, lost control when he attempted to drive up a hill. Whilst at the upper part of the hill the driver lost control of the vehicle and began moving in reverse until it flipped over. There were no major injuries sustained except minor injuries. All those involved were rushed to Mbala General Hospital for observation by the physician and were since given two days bed rest.
- In Nchelenge District, an attempted sexual assault was reported on November 17, 2017 involving a female SOP. The incident happened when a female SOP went to spray a structure in Kashikishi catchment area in Kapepa Village. The matter was reported to the Zambia police and the suspect was apprehended pending investigations. The victim was then provided with counselling and was given five (5) days paid leave before she returned to work in a different position as a washer, though she still maintained her SOP rate.
- In Mpulungu District, data falsification and insecticide theft incidents involving 36 SOPs were recorded in two catchment areas, namely Mpulungu and Isoko. The DCV exercise made it easier for the M&E team to observe discrepancies between the M&E spray data and DCV data. After verification, 36 SOPs were found to be falsifying spray data in Mpulungu, thereby increasing their daily spray coverages on the SOP data collection form. Moreover, one SOP and one TL were also found guilty of colluding with the household owners in Isoko to divert insecticide meant for the daily use in exchange for money. As a corrective measure, all the affected SOPs were dismissed with immediate effect and will not be engaged in any future PMI IRS activities in Zambia, and the two found guilty of selling the insecticide were reported to the local police. Furthermore, IRS was suspended in order to rectify the situation until door-to-door spray data verification exercise was completed. IRS implementation was only resumed after the spray teams from Mbala and Kasama Districts were able to travel to Mpulungu to ensure that all structures falsely recorded as sprayed were resprayed. This case was reported to the United Stated Office of the Inspector General.
- In Lundazi District, a fuel fraud incident was recorded involving AIRS temporary stores officer colluding with three (3) hired SOPs, contracted vehicle drivers, and a fuel attendant in diverting

fuel meant for IRS implementation in exchange for money. This was discovered during the fuel record reconciliation exercise by the ECO, an activity which was sanctioned by the AIRS COP after he received an additional fuel cash request only two weeks into the spray campaign. The initial amount of money was budgeted to last throughout the entire spray campaign. During the record reconciliation exercise it was discovered that approximately 1,325 liters of fuel worth ZMK 14,694.25 was misappropriated and the four (4) individuals who colluded did not refute the allegations but asked for forgiveness. The admissions of guilt was thus signed and documented. The case was reported to both the Zambia Police and the United States Office of the Inspector General for further investigation. The suspects were subsequently apprehended and released on police bond. As a corrective measure, the three drivers and the stores officer were dismissed with immediate effect and the money was recovered from the store officer and transporter's final pay. Additionally, the Lundazi AIRS DC was relieved from handling any financial transactions, including approval of fuel purchases meant for IRS, pending a disciplinary hearing for possible collusion and his duties were taken up by the Kasama and Nakonde DCs who had finalized their spray campaigns in their respective districts.

8.14 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.

8.14.1 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. 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.
- 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 leftover chemical 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 2018 IRS campaign. All IRS wastes were collected from the districts and are temporarily kept at the Lusaka Cleansing Depot 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 areas have 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).

PPE: Overalls, helmets, face shields and gum boots were thoroughly washed with soap and water and kept safely in the provincial storage facility for use in the 2018 spray campaign.

Defective Pumps: 407 defective Hudson spray pumps, and other IRS equipment that got damaged during IRS implementation have safely been stored in the district store rooms and will be repaired before the commencement of the 2018 spray campaign.

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

8.14.2 IRS WASTE DISPOSAL

The table below shows the categories of IRS solid waste generated in the 2017 campaign.

TABLE 9: CATEGORIES OF IRS SOLID WASTE FOR 2017 AIRS IRS CAMPAIGN

Plastic	Cloth	Rubber	Paper
Empty Bottles	Used Nose Masks	Gum Boots	Empty Actellic Boxes
Polythene sheets	Cloth	PVC Gloves	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 clearly 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 2017 Zambia IRS campaign:

Insecticide Containers: In the previous spray seasons the NMEP and AIRS Zambia had been faced with challenges in the management and disposal of insecticide containers since Actellic 300 CS was introduced to the program in 2012. However, in 2017 AIRS Zambia, NMEP, and ZEMA identified a local recycling company called Wonderful Group Industry Ltd that recycled a total of 52,330kgs of insecticide containers into pellets. Therefore, by February, 2018 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 as well as removal of labels and seals prior to recycling in Zambia at Wonderful Group Industry Ltd and Greenland Services Ltd.

Expired Insecticides: In 2017 PMI AIRS Zambia managed to destruct a total of 17,530 expired bottles (14,602.5 Liters) of Actellic 300CS which were leftover insecticides from the 2014 spray campaign, through high temperature incineration at Ndola Lime in presence of ZEMA officials.

Cardboard Boxes: Uncontaminated boxes will be supplied to Paper Milling plants as raw material in the manufacturing of carton boxes, books and pencils before March 31, 2018. Contaminated cardboard boxes on the other hand (i.e., cardboard boxes that contained insecticides with damaged packaging) will be incinerated with nose masks at the University Teaching Hospital incinerator by March 31, 2018.

Gloves and Boots: 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 deserving SOPs for their personal use by March 31, 2018.

Dust Masks, Overalls, and Back Sacks: Waste dust masks are always considered as contaminated and hazardous and will therefore be incinerated using University Teaching Hospital incinerators before March 31, 2018. Overalls and back sacks that would no longer be used for IRS will be given to deserving SOPs for their personal use, after they are thoroughly washed with

adequate soap and water by March 31, 2018. Table 10 shows the summary of type, quantity and disposal stream of the 2017 IRS solid waste.

TABLE 10: SUMMARY OF TYPE, QUANTITY AND DISPOSAL STREAM OF THE 2017 IRS SOLID WASTE

Waste Category	Quantity	Disposal Method
Empty Bottles	168,771 bottles	Recycling in Zambia after thorough cleaning, removal of labels, compression and baling
Plastic Sheeting	391.4 Kg	Disposal at the national dumpsite in Lusaka after thorough cleaning with soap & water
Helmet & Face Shields	164.2 Kg	Disposal at the national dumpsite in Lusaka after thorough cleaning with soap & water
Boots	564.9 Kg	Worn out boots will be given to deserving SOPs after been thoroughly cleaned with soap & water
PVC Gloves	305 Kg	Prior to their disposal in a landfill, worn out gloves will be cleaned with soap and water and shredded.
Used Nose Masks	849.9 Kg	Masks will be weighed at the point of generation and will be incinerated at UTH incinerator in Lusaka
Mutton Cloth	531.5 Kg	To be given to each and every SOP for their personal use after washing with soap & water
Worn out Overalls and Back Packs	390 Kg	Overalls and Bags will be given to deserving SOPs after been thoroughly cleaned with soap & water
Carton Boxes as packaging for Nose masks, pumps and other IRS items	214.5 Kg	Contaminated boxes will be incinerated whereas uncontaminated boxes will be supplied to a paper milling plant 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.

In entomology, AIRS continued to provide capacity building to district-level environmental health officers and human landing collectors to manage entomological data collection in six sentinel sites.

As part of capacity building, in the 2017 work plan, the Zambia AIRS team planned to provide financial support to NMEP to ensure that all IRS technical working groups were functional. Zambia AIRS supported the 2017 Insecticide Resistance Management Technical Working Group IRMTWG) as well as the Technical Advisory Committee meetings as part its central-level support. In addition, Zambia AIRS continued national-level entomologic support the insectary at NMEC to ensure its continued functioning. During the period under review, the program supported quarterly IRS related technical working groups. The main aim of these TWGs is to make sure that the program has efficient technical policies, procedures, and standards to ensure correct application and sustainability of IRS protocols. Also, as part of the capacity building, AIRS Zambia planned to organize a post-spray meeting with NMEP during 2017 to discuss the 2017 IRS campaign and the plan for the 2018 spray campaign.

In 2017, AIRS Zambia developed a capacity building plan in collaboration with the NMEP and PMI. One of the main activities was to improve the M&E capacity for NMEP and therefore AIRS Zambia trained the CEHOs, all IRS Managers and Supervisors in IRS monitoring and supervision as well as data collection, analysis and reporting. Moreover, all M&E tools have been shared with NMEP for use in other GRZ supported IRS sites. All trained GRZ Officers were involved in monitoring and supervision of the IRS implementation and, as a result of these capacity building efforts, the CEHO for Northern Province was able to uncover data falsification and insecticide theft in Mpulungu District.

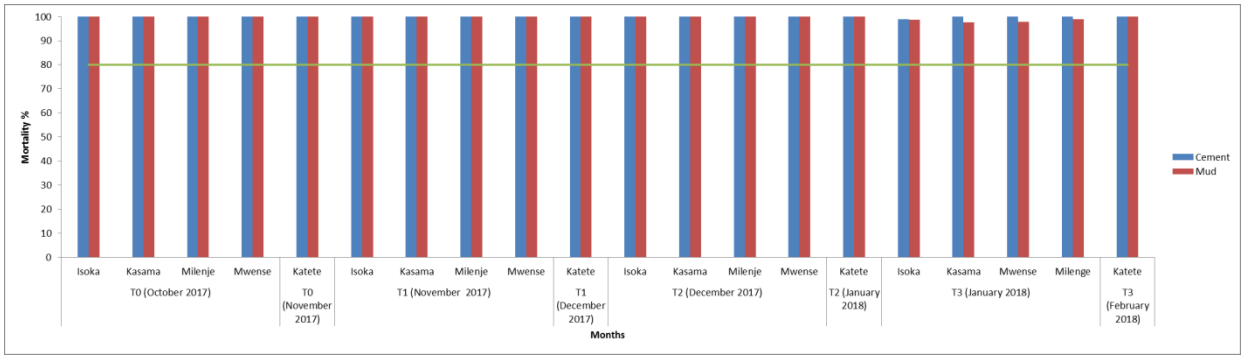
10. ENTOMOLOGY

AIRS Zambia has been performing the 2017 IRS campaign entomological surveillance on a monthly basis. Entomological surveillance is a key component for malaria vector control interventions assessment and for IRS programming, providing information on the impact of IRS on vector density and behavior in IRS areas. Entomological activities also assess the quality of the IRS operations, the decay rates of insecticide applied, and the vector susceptibility to insecticides used for malaria vector control. AIRS Zambia is supporting the NMEP to generate data on key entomological indicators, including spray quality assessment through the cone bioassay tests, whose summary results for 2017 IRS campaign are outlined below.

The baseline data were collected in August-September 2017 and the impact of the IRS on malaria vectors was carried out in November and December 2017. Detailed information on the malaria behavior will be shared in the entomological progress and final reports.

The spray quality assessment was carried out in five districts 24-48 hours after spraying. The cone bioassay test was conducted in a total of 28 treated houses (14 mud and 14 cement houses) and 10 control (unsprayed) houses (Five mud and five cement) at T0 and 30 treated (15 mud and 15 cement houses) and 10 control (untsprayed) houses at T1, T2 and T3. The T0 cone bioassay was conducted in Kasama, Isoka, Milenge and Mwense in October and in Katete in November following the IRS calendar. All the mosquitoes exposed to the sprayed walls were dead after the 24 hour holding period at T0 in October and November for Katete district. The 100% mortality was also recorded at all sites for both mud and cement sprayed walls, at T1 and T2 for all sites, corresponding to one and two months after spraying, respectively. The mortality for mud and cement sprayed walls three months after spraying was still above the 80% mortality threshold. The mortality for cement sprayed houses three months after spraying (February for Katete and January for Kasama, Isoka, Milenge and Mwense) was 100% except in Isoka district where the mortality was 98.9%. The mortality for mud sprayed houses three months post-spray was 98.8% in Isoka, 97.6% in Kasama, 97.8% in Mwense, 98.9% in Milenge, and100% in Katete three months after spraying (Figure 4). The average mortality due to airborne effect of Actellic CS was respectively 90.3% in October, 52.4% in November, 43.1 % in December and 20.9% in January.

FIGURE 4: Mortality Of Kisumu Susceptible Strain Of *An. Gambiae* S.S. After 30 Mins Exposure To Pirimiphos-Methyl Cs And 24h Holding Period At T0, T1, T2 and T3 In Kasama, Isoka, Milenge, Mwense, And Katete



11. Challenges and Lessons Learned

11.1 Challenges

The main challenges experienced during the IRS campaign included:

- Despite massive IEC/SBCC efforts, the campaign experienced low IRS acceptability rates in some catchment areas; during the 2017 IRS season higher than average rates of refusal were observed in Mansa (46%), Kaputa (52%), Luwingu (49%), Mporokoso (49%) and Mungwi (49%). The most common reason was because IRS was being associated with an increase in the number of fleas in some households. In urban parts of the district, refusals were associated with the smell of the insecticides and the fact that home preparation (removal of all belonging) is difficult in urban housing situations. In a few instances, household owners did not give any reasons for refusing IRS. In most of the catchment areas with low acceptability, AIRS Zambia involved traditional and political leadership to increase acceptability. Special teams of mobilizers were brought in to engage the urban community.
- There were several reported instances of dissatisfaction among affected community members and district health officials as a result of the OR study's targeting methodology that left out some target areas that had initially been targeted for spraying in the 2017 IRS season. In order to mitigate the impact of the change in target areas, community mobilization and sensitization continued throughout the spray campaign in the affected districts. This was enhanced with radio shows and use of a PA system. Additionally, stakeholder meetings were held to explain the criteria used in the targeting methodology.
- In Mpulungu District, AIRS Zambia encountered poor supervision from the GRZ supervisors, which led to data falsification by 36 SOPs. Additionally, two individuals, one SOP and one TL, were caught reselling in insecticide in Isoko catchment area. As a corrective measure, all the affected SOPs were terminated and IRS was suspended in order to rectify the situation until door to door spray data verification exercise was completed. IRS implementation was only resumed after the spray teams from Mbala and Kasama Districts were engaged to complete the exercise.
- The last-minute adjustments in targeted areas in Eastern Province in the to address the OR study criteria presented a number of challenges, including:
    - The length of the campaign was increased by 7 days as a result of the new target areas at a cost of $66,000. Since these areas were not previously mobilized, the campaign was completed in 66 days, not the originally planned 59 days.
    - The quality of mobilization and supervision was affected as a result of the need to adjust the preparations to accommodate novel approaches due to the OR study. The expected quality of mobilization, spray, and supervision also decreased. Mobilization was done quickly to help ensure that the campaign finished before the heaviest rains. Similarly, there were some implications on supervision as a result of the new targeting strategy. District Coordinators who were supposed to be providing field supervision had been pulled away from their regular duties to figure out how many additional structures need to be mobilized and how many more resources was needed for this activity.

11.2 LESSONS LEARNED

- Engagement of traditional leaders in rural areas and political section leaders in urban areas as mobilizers at the operational site level to conduct mobilization is critical in the acceptability of IRS in the rural parts of the districts.
- AIRS Zambia implemented pre-season spray activities well before the start of IRS resulting in the team commencing the spray campaign in good time.
- Regular feedback of performance of data of spray teams in the field helped to improve spray coverage as mop up teams could effectively use this data to revisit structures that had been found but not sprayed during the first field visit
- Introduction of sub-IRS operations site in large districts such as Chipata and Lundazi helped in the smooth running of the IRS implementation. This measure enhanced adherence to environmental compliance guidelines
- Using mSpray maps to determine spray coverage and plan the next target areas proved to be helpful to the spray teams during IRS operations as a result of an update to the number of structures as well as updated catchment area boundaries.
- Using mSpray maps to determine spray coverage and plan the next target areas was useful for district field teams during IRS operations in the six districts with mSpray. In addition, mop-up teams were able to easily navigate back to structures that required re-visits. The maps for Eastern Province were created using a 2017 base map, so the maps were more accurate than maps in Luapula during prior mSpray campaigns since those maps used imagery from 2015.

ANNEX 1: PROCUREMENTS

[A] INTERNATIONAL PROCUREMENTS

Item	Quantity before the campaign	Quantity procured	Total	Quantity Used	Quantity Damaged	Quantity remaining after campaign
Spray Pumps (Hudson and Goizper)	1,548	340	1,588	1,737	750	987
Hard Hats	2,188	208	2,396	2,150	0	2,396
Face Shields	0	2,000	2,000	2,000	2,000	0
Nose Masks	0	68,640	68640	68,640	0	0
Actellic 300 CS (bottles)	50	162,156	162,206	162,206	0	0
Pressure Gauges (for pumps)Hudson Pump	0	54	54	54	0	0
Repair Kits (for pumps) Goizper	0	700	700	700	0	0
Gloves	0	6,048	6,048	6,084	6,084	0
Gumboots	1,807	886	2693	1,727	986	0
Insecticide bags	1,207	459	1,666	1,666	560	1,106
CFVs	715	1000	1,715	1,715	1,127	538
Nozzles 8002	894	600	1,494	1,494	882	612

[B] LOCAL PROCUREMENTS

`Item	Quantity Before the Campaign	Quantity Procured	Total	Quantity Used	Quantity Damaged	Quantity remaining after campaign
Overalls	2,959	2,040	4,999	4,999	1,104	3,895
Bath soap	0	4,435	4,435	4,361	0	74
Safety Shoes	109	0	109	109	0	0
Socks	577	2,150	2,727	2,717	2,717	10
Tooth brushes	0	2,235	2,235	2,235	0	0
Washing soap	105	8,020	8,125	8,087	0	38
Mutton cloth	944	2,200	3,144	2,978	0	166
Daily SOP card	0	67,043	67,043	67,043	0	0
Mobilization Cards	0	67043	67,043	67,043	0	0
Error Elimin. Forms	0	17,775	17,775	17,775	0	0
Team Leader Forms	0	14,747	14,747	14,747	0	0
Zip tags	0	25,031	25,031	25,031	0	0
DCV Forms	0	6,540	6,540	6,540	0	0
IRS Cards	0	635,552	635,552	635,552	0	0

ANNEX 2: SPRAY START AND END DATES BY DISTRICT

Province	District	Spray Details		
		No. Spray days	Spray Start Date	Spray End Date
Eastern	Chadiza	30	17-Oct	26-Nov
	Chipata	43	31-Oct	16-Dec
	Katete	44	01-Nov	16-Dec
	Lundazi	42	01-Nov	15-Dec
	Mambwe	28	31-Oct	16-Nov
	Nyimba	42	31-Oct	22-Nov
	Petauke	36	17-Oct	10-Dec
	Sinda	21	17-Oct	05-Nov
	Vubwi	26	17-Oct	11-Nov
	Chama	30	17-Oct	21-Nov
Muchinga	Chinsali	25	17-Oct	20-Nov
	Isoka	17	17-Oct	07-Dec
	Mpika	27	16-Oct	11-Nov
	Mafinga	17	16-Oct	04-Nov
	Shiwang'andu	18	30-Oct	21-Nov
	Nakonde	30	16-Oct	30-Nov
Northern	Chilubi	35	16-Oct	25-Nov
	Kaputa	37	16-Oct	25-Nov
	Kasama	39	16-Oct	28-Nov
	Luwingu	30	16-Oct	25-Nov
	Mbala	27	16-Oct	21-Nov
	Mporokoso	25	02-Oct	03-Nov
	Mpulungu	35	16-Oct	10-Nov
	Mungwi	40	16-Oct	20-Nov
	Nsama	21	16-Oct	10-Nov
Luapula	Mansa	44	16-Oct	08-Dec
	Chembe	24	20-Oct	05-Dec
	Chipili	20	16-Oct	01-Dec
	Samfya	37	16-Oct	09-Nov
	Mwense	30	16-Oct	20-Nov
	Kawambwa	26	02-Oct	08-Nov
	Mwansabombwe	27	16-Oct	18-Nov
	Nchelenge	54	16-Oct	10-Dec
	Chiengi	31	16-Oct	09-Dec
	Milenge	17	16-Oct	14-Oct

ANNEX 3: SPRAY PROGRESS AND COVERAGE BY DISTRICT

Province	District	Spray Progress	Target	Found	Sprayed	Spray Coverage Before Mop-Ups	Number of Mop-Ups	Spray Coverage After Mop-Ups	Total Population Protected			
									Male	Female	Pregnant women	Children < 5
Eastern	Chadiza	94%	16,042	16,591	15,127	82%	1,361	91%	28,256	28,382	1,054	9,742
	Chipata	100%	75,041	79,707	74,826	87%	5,238	94%	164,618	160,192	7,145	43,007
	Katete	93%	24,756	26,833	23,051	80%	1,383	86%	43,494	43,610	1,623	12,907
	Lundazi	100%	31,909	34,924	31,791	87%	1,272	91%	64,725	65,429	2,642	17,487
	Mambwe	124%	9,221	12,238	11,401	89%	456	93%	22,823	22,894	792	6,318
	Nyimba	104%	13,116	14,361	13,699	85%	1,370	95%	23,396	23,544	1,069	6,941
	Petauke	109%	40,463	47,650	44,061	92%	0	92%	79,304	78,373	3,167	24,234
	Sinda	89%	7,097	6,469	6,325	97%	63	98%	13,657	14,068	535	4,421
	Vubwi	111%	5,716	6,867	6,354	89%	254	93%	12,856	12,515	467	4,111
	Total	**103%**[1]	**223,361**	**245,640**	**226,635**	**87%**	**11,397**	**92%**	**453,129**	**449,007**	**18,494**	**129,168**
Muchinga	Chama	110%	16,778	18,996	18,463	96%	185	97%	40,896	40,378	1,896	12,292
	Chinsali	110%	12,802	15,238	14,065	91%	141	92%	37,506	36,268	1,893	9,063
	Isoka	104%	5,975	6,612	6,215	91%	186	94%	13,288	12,625	516	3,763
	Mafinga	110%	8,316	9,775	9,166	94%	0	94%	20,732	20,907	1,192	5,964

[1] **Targeting differed in 6 districts (Chadiza, Katete, Lundazi, Mambwe, Nyimba and Vubwi) due to the OR study and the coverage also represents spraying in buffer targeted areas.**

	Mpika	111%	14,099	17,077	15,623	87%	625	91%	40,989	40,352	1,463	9,636
	Nakonde	100%	14,096	15,550	14,103	85%	846	91%	31,342	31,246	1,252	9,616
	Shiwang'andu	102%	4,433	4,845	4,524	91%	90	93%	11,491	11,272	397	3,224
	Total	**107%**	**76,499**	**88,093**	**82,159**	**90%**	**2,073**	**93%**	**196,244**	**193,048**	**8,609**	**53,558**
Northern	Chilubi	109%	13,166	15,121	14,353	93%	287	95%	38,159	38,626	1,926	12,713
	Kaputa	96%	11,575	11,772	11,070	93%	111	94%	31,620	31,021	1,809	10,976
	Kasama	94%	25,850	25,693	24,321	83%	2,919	95%	58,055	57,359	4,001	14,985
	Luwingu	112%	14,676	17,491	16,397	87%	1,148	94%	42,267	41,664	2,360	13,961
	Mbala	93%	10,736	10,746	9,992	84%	899	93%	26,605	26,005	1,619	10,002
	Mporokoso	110%	12,410	14,280	13,596	95%	0	95%	33,402	33,133	1,677	9,573
	Mpulungu	67%	12,878	10,132	8,640	69%	1,382	85%	22,962	23,014	1,145	7,360
	Mungwi	97%	16,428	17,174	15,854	85%	1,110	92%	39,877	37,765	1,598	10,801
	Nsama	101%	8,207	8,681	8,278	93%	166	95%	23,204	23,125	1,057	7,864
	Senga	84%	5,111	4,628	4,273	82%	427	92%	11,707	11,164	652	4,247
	Total	**97%**	**131,037**	**135,718**	**126,774**	**86%**	**8,448**	**93%**	**327,858**	**322,876**	**17,844**	**102,482**
Luapula	Chembe	98%	5,713	5,952	5,597	93%	56	94%	13,812	13,907	632	4,291
	Chienge	101%	39,718	42,884	40,186	90%	1,607	94%	110,235	105,024	8,495	30,149
	Chipili	108%	1,718	2,069	1,854	89%	19	90%	4,851	4,802	202	1,573
	Kawambwa	106%	19,345	22,050	20,552	91%	411	93%	53,402	52,685	2,495	15,693
	Mansa	87%	34,883	32,486	30,484	77%	5,182	94%	77,370	77,831	4,059	20,047
	Milenge	98%	5,023	5,269	4,903	88%	245	93%	12,096	12,369	510	3,943
	Mwansabombwe	85%	10,802	10,111	9,211	88%	276	91%	25,752	26,059	1,359	8,264
	Mwense	90%	26,415	26,032	23,727	90%	237	91%	66,883	69,129	5,149	19,258

	Nchelenge	75%	40,580	34,367	30,366	82%	1,822	88%	86,875	85,891	5,251	27,859
	Samfya	95%	33,706	33,964	31,923	91%	958	94%	81,127	83,414	4,107	26,855
	Total	**94%**	**217,903**	**215,184**	**198,803**	**87%**	**10,814**	**92%**	**532,403**	**531,111**	**32,259**	**157,932**
Total		**98%**	**648,800**	**684,635**	**634,371**	**88%**	**32,732**	**93%**	**1,509,634**	**1,496,042**	**77,206**	**443,140**

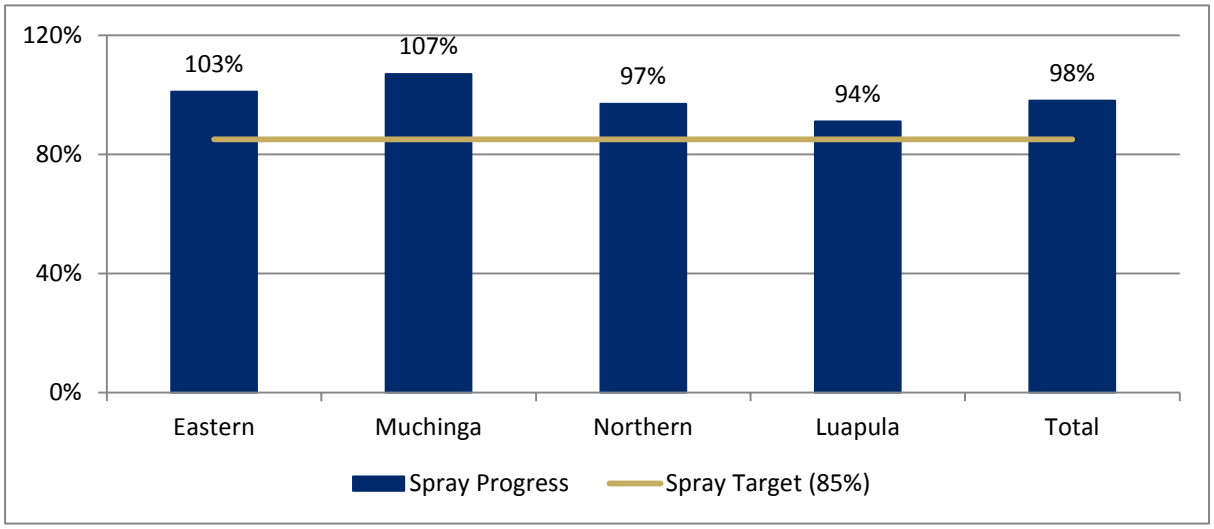
ANNEX 4: TARGETED CATCHMENT AREAS

District Name	Number of catchment areas per district	Number of AIRS targeted catchment areas per district	Total number of structures in entire district *reported by district	Number of Eligible structures per district	Number of eligible structures in (AIRS) targeted catchment areas	Total number of eligible structures in none -targeted catchment areas	Number of found structures per district	Number of sprayed structures per district
Eastern	**267**	**153**	**498,672**	**444,637**	**223,361**	**221,276**	**245,640**	**226,635**
Chadiza	20	9	31,372	25,668	16,042	9,626	16,591	15,127
Chipata	61	42	165,561	141,664	75,041	66,623	79,707	74,826
Katete	24	17	39,826	38,640	24,756	13,884	26,833	23,051
Lundazi	49	18	86,249	78,190	31,909	46,281	34,924	31,791
Mambwe	17	8	20,236	18,081	9,221	8,860	12,238	11,401
Nyimba	20	14	22,150	20,434	13,116	7,318	14,361	13,699
Petauke	41	27	78,501	69,183	40,463	28,720	47,650	44,061
Sinda	23	9	41,490	40,490	7,097	33,393	6,469	6,325
Vubwi	12	9	13,287	12,287	5,716	6,571	6,867	6,354
Muchinga	**109**	**62**	**180,751**	**151,233**	**76,499**	**74,734**	**88,093**	**82,159**
Chama	27	19	26,663	25,543	16,778	8,765	18,996	18,463
Chinsali	10	7	22,216	22,144	12,802	9,342	15,238	14,065
Isoka	11	5	24,818	24,760	5,975	18,785	6,612	6,215
Mafinga	11	3	21,496	14,429	8,316	6,113	9,775	9,166
Mpika	25	13	31,934	25,656	14,099	11,557	17,077	15,623
Nakonde	12	11	36,687	26,918	14,096	12,822	15,550	14,103
Shiwang'andu	13	4	16,937	11,783	4,433	7,350	4,845	4,524
Luapula	**143**	**95**	**301,557**	**272,686**	**217,903**	**54,783**	**215,184**	**198,803**
Chembe	5	5	6,064	5,713	5,713	0	5,952	5,597

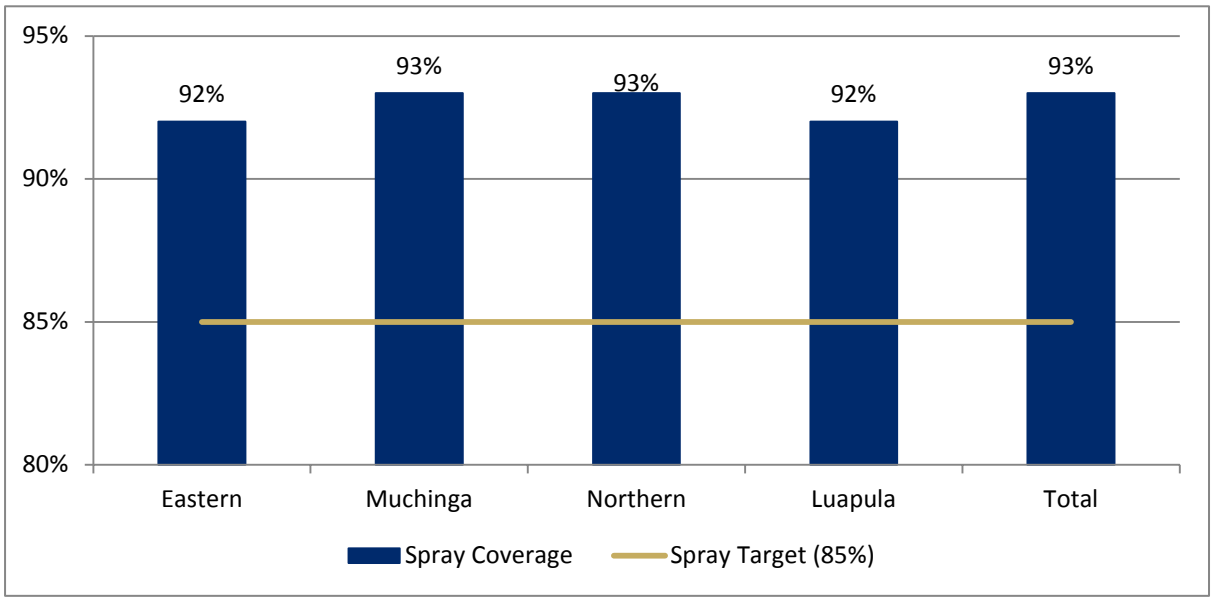
District Name	Number of catchment areas per district	Number of AIRS targeted catchment areas per district	Total number of structures in entire district *reported by district	Number of Eligible structures per district	Number of eligible structures in (AIRS) targeted catchment areas	Total number of eligible structures in none -targeted catchment areas	Number of found structures per district	Number of sprayed structures per district
Chienge	11	9	48,342	45,493	39,718	5,775	42,884	40,186
Chipili	13	8	6,401	6,070	1,718	4,352	2,069	1,854
Kawambwa	15	13	27,305	21,580	19,345	2,235	22,050	20,552
Mansa	24	16	45,386	39,812	34,883	4,929	32,486	30,484
Milenge	9	7	9,504	5,759	5,023	736	5,269	4,903
Mwansabombwe	6	5	14,009	11,807	10,802	1,005	10,111	9,211
Mwense	13	10	31,122	27,052	26,415	637	26,032	23,727
Nchelenge	15	11	47,816	44,332	40,580	3,752	34,367	30,366
Samfya	32	11	65,608	65,068	33,706	31,362	33,964	31,923
Northern	**157**	**79**	**321,622**	**278,997**	**131,037**	**147,960**	**135,718**	**126,774**
Chilubi	12	8	38,641	25,824	13,166	12,658	15,121	14,353
Kaputa	9	9	19,418	18,978	11,575	7,403	11,772	11,070
Kasama	37	15	60,078	56,533	25,850	30,683	25,693	24,321
Luwingu	10	8	32,607	24,042	14,676	9,366	17,491	16,397
Mbala	17	7	29,934	28,538	10,736	17,802	10,746	9,992
Mporokoso	14	12	20,343	13,180	12,410	770	14,280	13,596
Mpulungu	11	4	28,607	25,040	12,878	12,162	10,132	8,640
Mungwi	21	6	47,858	46,857	16,428	30,429	17,174	15,854
Nsama	8	7	15,792	15,505	8,207	7,298	8,681	8,278
Senga	18	3	28,344	24,500	5,111	19,389	4,628	4,273
Total	**676**	**389**	**1,302,602**	**1,147,553**	**648,800**	**498,753**	**684,635**	**634,371**

ANNEX 5: SPRAY PROGRESS AND COVERAGE

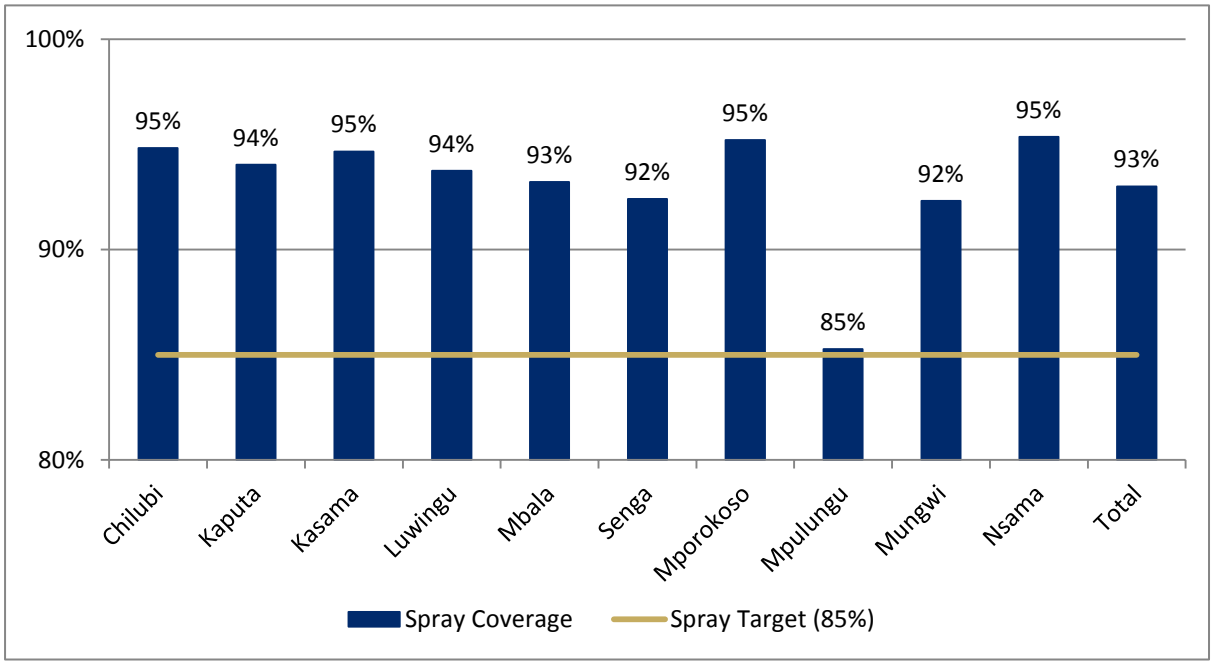
[A] PROVINCIAL SPRAY PROGRESS



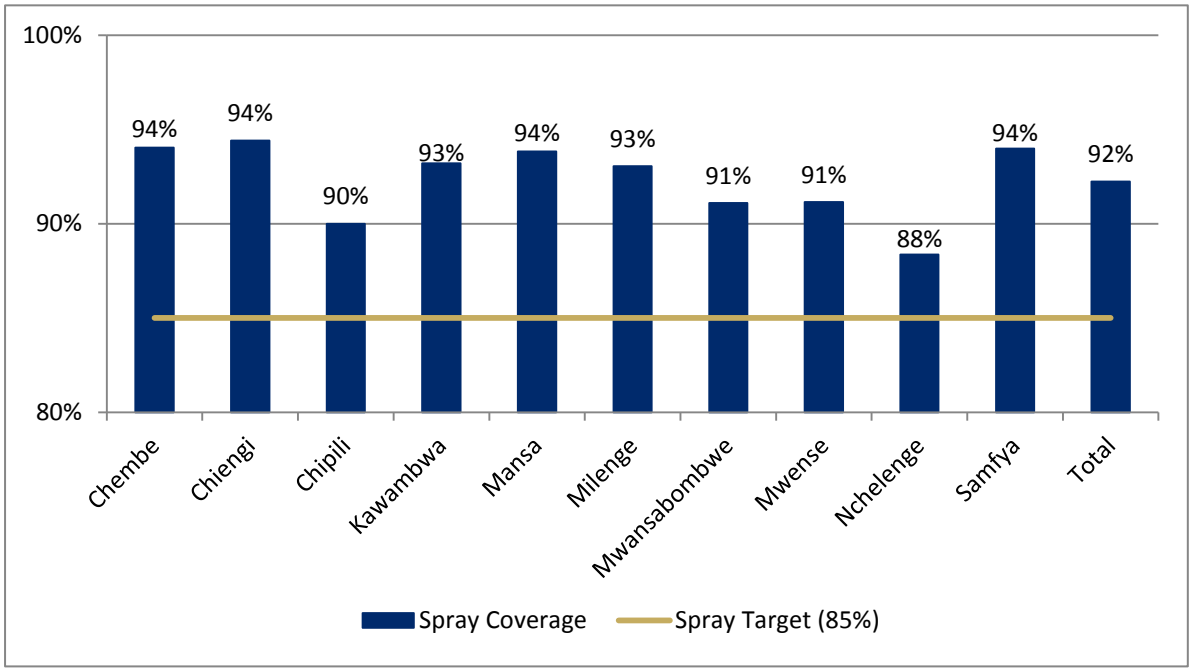
[B] PROVINCIAL SPRAY COVERAGE



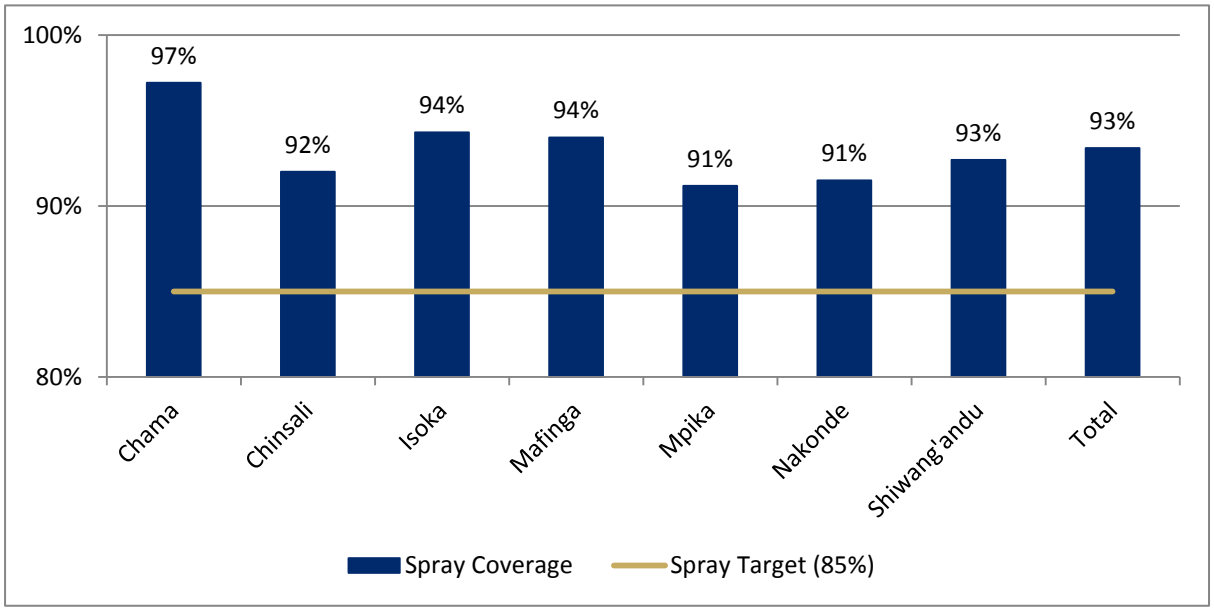
[C] District Spray Coverage, Northern Province



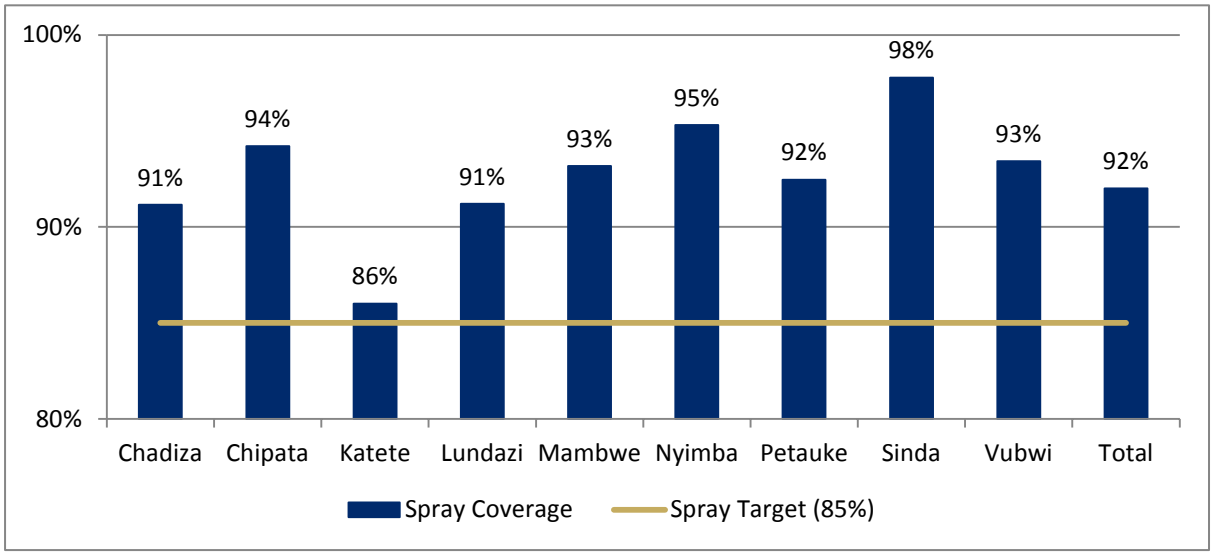
[D] District Spray Coverage, Luapula Province



[E] District Spray Coverage, Muchinga Province



[F] District Spray Coverage, Eastern Province



ANNEX 6: M&E PLAN MATRIX – 2017 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%	1; 100%	1: 100%	1: 100%	1: 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%	1; 100%	1: 100%	1: 100%	1:100%
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%	1; 100%	1: 100%	1: 100%	1: 100%
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	1; 100%	1: 100%	1:100%	1:100%
1.1.5 Successfully completed spray	Data source: Project records	By Spray	Completed	Completed	Completed	Not	Completed	Completed

operations without an insecticide stock-out	Reporting frequency: Each spray campaign	Campaign				Completed, But more chemical was procured.		
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	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[2]; 99%	70; 100%	83; 119[3]%	83; 100%	90; 108%
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; 98%	35; 100%	51;146%	51; 100%	54[4]; 106%
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	Completed	Completed	Completed	Completed
Component 2: Implement safe and high quality IRS programs and provide operational management support								
2.1 Planning and Design of IRS Programs								
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	Completed	Completed

[2] 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
[3] There was an increment in the number of operational sites and therefore there was need to train more logistics and warehouse managers
[4] There were some districts that were subdivided and therefore more IRS operational sites needed to be created

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%	-10%	5%	xxxxx	5%	xxxxx
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 on schedule agreed upon with the-PMI COR team	Data source: Project records – submitted SEAs/ letter reports Reporting frequency: Each spray campaign	By Spray Campaign	Completed	Completed	Completed	Completed	Completed	Completed
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	1,914	2,073	2,001 1,346 Males 655 Females	2,382	2,486[5] 1,634 Males 852 Females
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	70	64 47 Males 17 Females	72	42[6] 29 Males 13 Females
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	1	0	0
2.2.5 Number and percentage of soak pits and storehouses inspected	Data source: Project records – Reports submitted by	By Spray Campaign	80; 100%	89;125%	70; 100%	102, 146%	102; 100%	108[7]; 106% 54 Fixed

[5] **This includes 1,797 SOPs, 352 TLs, 247 Supervisors and 90 Store Keepers**
[6] **The number of health workers trained was reduced due to the reduced budget and this was one of activities that was affected.**
[7] **This number includes 54 soak pits and 54 store houses. There were additional soak pits that were renovated before commencement of the 2015 spray campaign**

and approved prior to spraying	district environmental officers Reporting frequency: Each spray season	By Soak Pit By Storehouse				51 Soak Pits 51 Storehouses		Soak Pits 54 Storehouses
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	760	319	760	2,940[8]
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	39,000	37,000	8,500	67,500	47,750[9]
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	1,144,790	1,322,580 Male: 611,762 Female: 710,818	1,322,580	1,386,678 Male: 618,349 Female: 768,329
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	549,724	542,184	612,929	648,800	684,635
2.4.2 Number of structures sprayed with IRS	Data source: Daily Spray Operator Forms	By Spray Campaign	549,724	519,598	542,184	559,550	551,480	634,371

[8] **Radio spots were increased in the 2017 spray campaign because off the high refuses in the 2016 spray season**
[9] **This includes 7,000 FAQ, 6,000 job aides, 250 Malaria strategy, 25,000 Talking Points, 9,500 Posters**

	Reporting frequency: Daily per spray campaign							
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%	91%	85%	93%
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 By children <5 years old	2,689,782	2,544,290[10]	2,475,741[11]	2,626,718[12] Male;1,320,750 Female; 1,305,968, Preg Wom; 69,118, Child < 5; 399,367	3,098,790	3,005,676 Male; 1,509,634 Female; 1,496,042, Preg Wom; 77,206, Child < 5; 443,140
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	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	NA	NA	Completed	Completed	Completed	Ongoing
Component 4: Contribute to Global and Country Level IRS Policy Setting and Develop and Disseminate Experiences and Best Practices								
4.1 Number of	Data source: Project records	By Spray	3	3	3	3	3	4[13]

[10] **This number includes 1,268,242 males and 1,276,048 females of which 67,107 are pregnant women and 392,903 are children**
[11] **This figure includes 1,233,648 men, 1,242,093 women of which 65,585 pregnant women and 382,630 children under 5 years**
[12] **This figure includes 1,233,648 men, 1,242,093 women of which 65,585 pregnant women and 382,630 children under 5 years**
[13] **This includes talking points guidelines for religious leaders, traditional leaders, mobilizer job aid and Gender awareness posters**

guidelines/checklists/tools related to IRS operations developed or refined with project support	– Activity reports Reporting frequency: Semi-annually	Campaign By guideline/ checklist/tool						
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	2	1	2	1[14]
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	2	4	2	2[15]
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	2	3	2	2[16]
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	6	6	6	6
5.1.2 Number and percentage of	Data source: Entomological	By Spray	6;100%	0;0%	6; 100%	6; 100%	6; 100%	6; 100%

[14] **One IRS communication strategy**
[15] **PSDQA and Training of Trainers presentations**
[16] **Engagement of a local mining company participating in Training of Trainers and Poison management**

entomological monitoring sentinel sites measuring all the five primary PMI entomological monitoring indicators	reports Reporting frequency: Annually	Campaign						
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%	6	6; 100%	6;100%	6; 100%
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%	26	10; 39%	12; 100%	7; 58%
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	48	90	40	38
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	248	384	540	384	278
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	176	48	48	48	48
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**	**NA**	**NA**	**NA**	**NA**

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**	**NA**	**NA**	**NA**	**NA**
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 trained to deliver 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	1,435; 40% women	1,912; men: 1,347 women: 565 30% women	2,073	1,982; 32.6% Men: 647 Women: 1,335	2,369 Women; 948 (40%)	2,438[17] Males: 1,593 Females: 845
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	2,264	2,195 Male: 1,485 Female: 710 32%	2,762; 40% women	2,817[18] Males: 1593 Females: 845
6.1.3 Number and percentage of women recruited (i.e. number/percentage of women on the	Data source: Project records – Recruitment reports reports	By Country	506; 40% women	511; 31%	670; 40% women	521; 33% women	736; 40% women	834; 35% Women

[17] **This includes 42 clinicians, 1,797 SOPs, 352 TLs, 247 Supervisors**
[18] **This includes 90 clinicians, 1,797 SOPs, 352 TLs, 247 Supervisors, 90 store keepers, 73 M&E Assistants, 64 DECs and 104 Team Leaders Assistants**

selection list) for IRS employment	Reporting frequency: Semi-annually			women				
6.1.4 Number of people trained as IRS Training of Trainers	Data source: Project records – Training reports Reporting frequency: Semi-annually	By Spray Campaign By Gender Percentage of women trained	118; 40% women	182; Male: 144 Female: 38 21% Female	199	147; Male: 128 Women: 19, 12.9% women	192	247 Male: 188 Female: 59 (24%)
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; Male: 1199 Female: 510 30%	1,675	1,570 Male: 1,049 Female: 521 33%	2,405	2,362[19] Male: 1,528 Female: 834 35%
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	78	138	108 Team Leaders: 95, M&E Assistants: 13	144	139[20] Team Leaders: 125, M&E Assistants: 14
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 of	1,544	1,983 men: 1,380 women:603 30%	2,037	1,948 Men: 1,309 women:639 33% women	2063	2,394[21] Men: 1,553 women: 841, 35% women

[19] **This includes 1,797 SOPs, 352 Team Leader Assistants, 71 M&E Assistants, 52 DECs and 104 Team Leader Assistants. AIRS do not hire but do work with clinicians and store managers from MoH**

[20] **This includes 125 Team Leaders and 14 M&E Assistants**

[21] **This includes 1,797 SOPs, 352 Team Leader Assistants, 71 M&E Assistants, 52 DECs and 90 Team Leader Assistants, 9 Technical staff and 23 District Coordinators**

		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	199; Men; 119 Women; 80, 40% women	147; Men; 128, Women; 19 12.9% women	192	247
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	Completed	Completed	Complete	Completed	Completed
6.2.3 Zambia 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	Completed	Completed	Completed	Completed

ANNEX 7: 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 11 and October 14, 2017. In total 134 vehicles were inspected but only 90 vehicles were hired	Some of the trucks presented for inspection were not retrofitted with benches and railings, whereas others did not have necessary documentation. Other vehicles were not roadworthy.	After the inspections, all the trucks that were deemed suitable for use in IRS were retrofitted with benches, tents and handrails. Vehicles that were not roadworthy were not hired.
1b. Driver training	A total of 120 drivers were trained during driver trainings which were conducted between September 11, and October 14 in, Chipata, Mansa, Mpika and Kasama districts. In 12 instances of the 486 transportation vehicle inspections, drivers were reported to have not attended training. However these were instances where the transport vendor decided to substitute a driver without notifying the ECO for a one-to-one orientation and issues a certificate		The drivers that joined in the middle of the IRS campaign were given a one-on-one orientation with regard to the occupational health, safety and environmental safeguards when dealing with Actellic 300CS and transporting spray operators on the first day they reported for work by the AIRS personnel present though it was still needed to be reported that they did not attend the official drivers training.
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. Each vehicle was assigned a first aid box supplied by AIRS		All drivers were provided with PPE before the onset of the spray campaign and the 8 instances when it was reported that drivers had no PPE was because the monitors expected to find

	whereas spill management kits were provided by the transport vendors. In order to ensure that the required conditions were adhered to, a total of 486 morning mobilization inspections were conducted. In 8 instances, the vehicle was reported not to have all the items that make up a spill kit and the driver was without the required PPE in 8 instances.		drivers donned in full PPE even if they were not handling chemicals. However, this was discussed and information was disseminated to say drivers do not need to be in full PPE except coveralls and that other PPEs must 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 18 and October 10, 2017. 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 included physical examinations, Hb, and blood pressure tests.		
1f. Procurement of, distribution to, and training on the use of PPE for all workers with potential pesticide contact.	Both International and local procurements 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 247 Supervisors were trained during TOTs whereas 352 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 54 IRS operations sites were located within health center premises and a total of 2 new IRS operations sites with facilities such store room and soak pits were established whereas 2 old storage facilities were rehabilitated. The nine (9) fixed soak pits that were in bad condition during PSECA were renovated. In addition, 35 MSP for use as rinse barrels were provided prior to the commencement of the campaign. In overseeing the program adherence to the BMP guidelines, a total of 404 end of day cleanup inspections on both fixed and mobile soak pits were conducted by both AIRS Staff and MoH supervisors. And out of the 404 submissions on both fixed and mobile soak pits there was no instance was it reported that the operations site had no wash facilities or without soap and water available for operators.	.	All the IRS operational bases had wash facilities with adequate water, Soap, buckets and privacy. The camping sites also had temporary wash facilities which were certified prior to the commencement of the spray campaign. In districts were there was no running water washers used to draw and reserve water from the borehole for use during end of day clean up before SOPs return from the field.
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 404 inspections were conducted by the aforementioned staff. The number of non-compliant issues reported for the 54 fixed operations and camping sites inspected were 41 with one issue to do with water being observed to be in the collection barrel at the beginning of clean up in 10 instances?		In the initial stages of IRS operations, Team Leaders did not take time to supervise the end of day cleanup activities. Hence, in some districts e.g, Sinda SOPs used to come back with leftover insecticide in their tanks field but they could not carry everything on the following spary day which resulted to the first barrel being reported to have rinse water at the beginning of end of day clean up. This was addressed by the AIRS staff that had spread out in all the 364 districts. As a result the end of day cleanup

			supervisions gained momentum and compliance improved as the campaign progressed.
2a. IEC campaigns to inform homeowners of responsibilities and precautions.	Five thousand five hundred and sixty eight (5,568) community mobilizers were trained to conduct door to door community mobilization & 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		CCommunity mobilization was done , 2weeks before the commencement of the campaign and feedback or mobilization report was presented prior to launching the campaign except in Eastern province where mobilization was done during IRS implementation. The mobilization report was resourceful in determining the spray schedule.
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 1128 Homeowner preparations and spray operator performance inspections were conducted by both MoH and AIRS staff. In the initial stages of the campaign, in 25 instances, some structures were reported to have been sprayed without being properly prepared.	Inadequate house preparation if farm blocks and urban areas	The structures that were found to have been sprayed without been adequately prepared were re-spayed during mop up after having removed all the household goods that needed to be removed. However, in urban and farm blocks household preparation still remains a challenge due to huge number of household goods (e.g, maise) that require to be removed. As such, in some instances, this led to refusals and the only way to improve this is to engage packers to help in house preparations
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. The ECO, DCs and Supervisors played a pivotal role in championing this requirement		All the homeowners were informed of the post spray instructions and the three instances reported could be attributed to those instances when household owners decided to leave home for other activities before the 2-hours had elapsed and left instructions with children who could not memorize everything at the time of inspections.

	and as such, from a total of 1128 inspections conducted, only in 3 instances was a structure reported to have been 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.	Homeowners were instructed to wash their skin with plenty of water and soap if they experienced itching or visit the nearest clinic if itching persisted. In 10 instances out of the 1128 inspections conducted, a structure was reported to have been sprayed without informing residents of post spray instructions.	Failure by homeowners to recall the post spray protocols/ instruction given to them by SOPs .	Most of the SOPs left information with homeowners but it was observed that homeowners could at times forget the post spray 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. In 14 instances out of the 1128 inspections conducted, it was reported that SOPs were spraying wrong surfaces such as floors, metal roof, the outside of door, glass etc.		The 14 instances of non-compliance with regard to 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 put in place to prevent such Ec violations.
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 28 and October 10, 2017 in Luapula, Muchinga and Northern provinces. For the Eastern province, the training was conducted between October 16, and October 21, 2017. Out of the 1128 inspections conducted, there were 45 instances where a spray operator was reported to be non-compliant.		During the early stages (1st week) of spraying, SOPs who were new in the program were not consistent with the spray techniques and were retrained over the weekend in order to keep the up to spped with the technique. Therefore, as the program progressed this was controlled. (as indicated by the lower number of non-compliant issues reported later).

3c. Maintenance of pumps	Spray Pumps were serviced on daily basis by the TLs and supervisors prior to the deployment of SOPs. Out of 1128 inspections conducted, in 42 instances pumps were reported to be leaking while in the field. However, TLs and supervisors were always in the field to attend to such incidences and repair the defective pumps so that SOPs could resume work in no time.		
4a. Choose sites for disposal of liquid wastes, including Mobile Soak pit sites 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 54 fixed soak pit and 35 MSPs that were properly sited were in use during the 2017 IRS campaign. From theinspections conducted at MSP sites, there were no reports of badly selected MSP sites. Also, from the PSECA conducted, there were no reports of badly selected permanent soak pits.		All the sites selected for both FSP and MSP were suitable for the disposal of liquid waste.
4b. Construct fixed and Mobile Soak pits with charcoal to adsorb pesticide from rinse water.	Two (2) new soak pits were constructed as per design demonstrated in the BMP. The construction was supervised by the ECO, DCs, and MoH district representative before approval by ZEMA. 35 MSPs filled with granulated activate charcoal (GAC) were constructed and installed in 8 districts where camping of SOPs was needed in order to reduce the distance between the operations site and spray sites		The use of MSPs was welcome, as it reduced the cost and non-compliance issues associated with travelling long distances between the fixed IRS operations site and the spray sites. The end of day cleanup was expedited as only 5 SOPs needed to use one mobile soak pit which quickened the progressive rinsing process without congestion at the tarpaulin. At the fixed soak pit end of day clean

			ups were experdited by setting two sets of 7 rinse barrael each in order to avoid congestion at the soak pit
4c. Maintain soak pits as necessary during season.	The soak pits were well maintained such that, of the 404 on both FSP and MSP , there were no reports of the contaminated water failing to drain properly into the soak pits.		
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 and the AIRS Operations Manager before the commencement of the campaign.	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, uncontaminated waste, 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 shredded and buried at the national dumpsite. All empty bottles in boxes will be collected from the districts and taken to a central facility (Lusaka Cleansing Depot) awaiting thorough cleaning with soap and water; removal of labels and seals; prior to recycling in Zambia.. Contaminated boxes, as well as nose masks, will be incinerated at the University Teaching Hospital incinerators whereas uncontaminated boxes will be supplied to paper milling plants 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 andfrom the 138 storekeeper performance inspections conducted, there was no instance when the containers for empty sachets and used masks were reported not to be available and labeled.		The fact that most of the store keepers were not new in the program but had previously been engaged in the IRS campaign, made it easier for them to adhere to the PMI BMP guidelines. Additionally, the fact that all AIRS employees were in the field to monitor and supervise IRS operations, a number of non-compliant issues that were spotted were rectified immediately and corrective measures were implemented
4f. Monitoring disposal procedures post-campaign.	The ECO will monitor the post spray campaign solid waste disposal procedure. Collection of the 2017 IRS waste from the districts to the central facility (Lusaka cleansing depot) for disposal at the national dumpsite has been completed. The incineration of pesticide-contaminated wastes such as used nose masks will be conducted at UTH by February 2018.		Zambia had in the previous seasons no recycling companies to perform the recycling of empty bottles until in 2017 when ZEMA, AIRS & MoH identified local companies that recycled 52330Kg of empty bottles. Therefore, all the empty bottles from the districts will be delivered to the Lusaka Cleansing Depot for thorough cleaning, removal of labels and seals prior to recycling in Zambia
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 stores, as well as the sub-districts stores. Of the 138 storekeeper performance inspections conducted, there was no instance when the sum of the stock balance on the stock card + the stock issued out for the day + the stock balance of empty sachets/bottles did not equal to the opening balance in the ledger		The fact that most of the store keepers were not new in the program but had previously been engaged in the IRS campaign, made it easier for them to adhere to the PMI BMP guidelines. Additionally, the fact that all AIRS employees were in the field to monitor and supervise IRS operations let to recording little or no EC violations regarding IRS stock management number of non-compliant issues that were spotted were rectified immediately and corrective measures were implemented

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 3.8. This therefore means that, the standard average of 3.64 structures to be sprayed per bottle of insecticide was exceeded by 0.16.		Exceeding the targeted average structures to be sprayed per bottle of insecticides could be attributed to the fact that IRS in Zambia is administered in rural areas with some catchment areas having very small structures.
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 well as during the 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 Coordinator conducted physical inventory counts during and after the spray season with the storekeeper performance inspection checklist. A total of 138 inspections were conducted throughout the campaign there was no instance was the balance on stock cards could notequal results of physical stock..		Most of the storekeepers were not new to the program therefore, it was made easier for them to use stock control cards and daily insecticide usage registers, which resulted in no errors regarding entries on the stock cards. When the physical count was conducted, it was observed that the chemical used was equal to the empty bottles that were found.

ANNEX 8: INSECTICIDE USAGE

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	15,127	4,044	3.7	2.6	9.7
	Chipata	74,826	20,125	3.7	3.5	13.0
	Katete	23,051	6,187	3.7	3.5	13.0
	Lundazi	31,791	8,250	3.9	3.6	13.9
	Mambwe	11,401	3,129	3.6	3.8	13.8
	Nyimba	13,699	3,279	4.2	3.4	14.2
	Petauke	44,061	10,615	4.2	3.7	15.4
	Sinda	6,325	1,774	3.6	4.0	14.3
	Vubwi	6,354	1,929	3.3	3.4	11.2
	Total	**226,635**	**59,332**	**3.8**	**3.5**	**13.4**
Muchinga	Chama	18,463	4,374	4.2	3.9	16.5
	Chinsali	14,065	3,634	3.9	3.7	14.3
	Isoka	6,215	1,494	4.2	2.9	12.1
	Mafinga	9,166	2,579	3.6	3.0	10.7
	Mpika	15,623	4,025	3.9	3.1	12.0
	Nakonde	14,103	3,524	4.0	3.3	13.2
	Shiwang'andu	4,524	1,108	4.1	4.3	17.6
	Total	**82,159**	**20,738**	**4.0**	**3.4**	**13.5**
Northern	Chilubi	14,353	3,937	3.6	3.8	13.9
	Kaputa	11,070	2,894	3.8	3.9	14.9
	Kasama	24,321	6,754	3.6	2.4	8.6

	Luwingu	16,397	3,799	4.3	4.1	17.7
	Mbala	9,992	3,315	3.0	2.3	6.9
	Mporokoso	13,596	3,603	3.8	3.7	14.0
	Mpulungu	8,640	4,729	1.8	1.9	3.5
	Mungwi	15,854	4,107	3.9	2.9	11.2
	Nsama	8,278	2,052	4.0	3.5	14.1
	Senga	4,273	1,278	3.3	2.4	8.0
	Total	**126,774**	**36,468**	**3.5**	**3.1**	**10.8**
Luapula	Chembe	5,597	1,275	4.4	3.0	13.2
	Chiengi	40,186	9,539	4.2	3.9	16.4
	Chipili	1,854	**560**	3.3	2.8	9.3
	Kawambwa	20,552	4,529	4.5	3.3	15.0
	Mansa	30,484	9,494	3.2	3.1	10.0
	Milenge	4,903	1,656	3.0	3.9	11.5
	Mwansabombwe	9,211	2,244	4.1	2.4	9.9
	Mwense	23,727	5,880	4.0	3.6	14.5
	Nchelenge	30,366	8,876	3.4	2.7	9.2
	Samfya	31,923	8,180	3.9	3.1	12.1
	Total	**198,803**	**52,233**	**3.8**	**3.2**	**12.2**
Total		**634,371**	**168,771**	**3.8**	**3.3**	**12.4**