PMI | Africa IRS (AIRS) Project

Indoor Residual Spraying (IRS 2) Task Order Four

AIRS NIGERIA
2013 END OF SPRAY REPORT

JULY 2013

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ACRONYMS

AIRS	Africa Indoor Residual Spraying
BMP	Best Management Practices Manual
Bpn	Bites per person per night
CDC	Centers for Disease Control and Prevention
DCV	Data Collection Verification
EE	Error Eliminator
HLC	Human Landing Catch
ICC	Inventory Control Cards
IEC	Information, Education and Communication
IRS	Indoor Residual Spraying
FMEnv	Federal Ministry of Environment
LGA	Local Government Area
M&E	Monitoring and Evaluation
MBR	Man Biting Rate
NESREA	National Environmental Standards, Regulations and Enforcement Agency
NIPRD	National Institute for Pharmaceutical Research and Development
NMCP	National Malaria Control Program
PMI	President's Malaria Initiative
PPE	Personal Protective Equipment
SEA	Supplemental Environmental Assessment
SMOH	State Ministry of Health
TOT	Training of Trainers
USAID	United States Agency for International Development
WHO	World Health Organization

EXECUTIVE SUMMARY

Abt Associates, in furtherance of the President's Malaria Initiative Africa Indoor Residual Spraying project (AIRS), IRS 2 Task Order 4, implemented for the second year a spray operation program in Nasarawa Eggon and Doma Local Government Areas (LGA) of Nasarawa State, Nigeria. The objectives of the program remained unchanged from Year One and included the reduction of malaria-associated morbidity and mortality; the establishment of a model indoor residual spraying (IRS) program to set national performance standards; and the building of IRS capacity in Nigeria.

The project was implemented in collaboration with the National Malaria Control Program, the Nasarawa State Ministry of Health, the Federal Ministry of Environment, the National Environmental Standards and Regulations Enforcement Agency, and the Doma and Nasarawa Eggon LGA Councils.

The project team used the experiences and lessons learned in 2012 to develop and implement the 2013 spray campaign. The campaign also benefited from a recently established project insectary in Keffi town, which ensured the supply of adequate numbers of susceptible (Kisumu) and wild strains of mosquitoes for entomological monitoring and spray quality assurance.

The start of the spray operation was postponed by three weeks due to a delay in the arrival of the insecticide consignment, due to issues the new supplier had with customs clearance. Nevertheless, the project successfully completed the spray campaign before the rainy season began and achieved the following results during the 33 days of spraying between April 11- May 18, 2013:

1. Trained 653 spray operations personnel (16.2 percent female);
2. Sprayed 62,592 of 64,191 structures found by the spray operators, a 97.5 percent spray coverage; and
3. Protected a total population of 346,798, which included 16,733 pregnant women and 67,204 children under the age of five.

The project carried out entomological monitoring by conducting baseline and monthly activities. Spray quality assurance tests were carried out in 31 houses. The test results of average 24-hour mortality were 100 percent with susceptible (Kisumu) strains of *Anopheles gambiae s.s.* and 99.8 percent with field collected (wild) *Anopheles gambiae s.l.* mosquitoes from the intervention areas for the month of April, and 100 percent with Kisumu and 98.9 percent with wild mosquitoes in May. In June, 24-hour mortality was 98.7 percent with Kisumu strains and 82.9 percent with wild *Anopheles* mosquitoes using standard World Health Organization cone assay.

1. Introduction

1.1 Project Objectives in 2013

The Africa Indoor Residual Spraying (AIRS) Nigeria project had two major objectives for the spray campaign of 2013:

1. To further the National Malaria Control Program (NMCP) and President's Malaria Initiative (PMI) goal of reducing malaria-associated mortality in two selected LGAs in Nasarawa State, Nigeria.
2. To establish a model indoor residual spraying (IRS) program at a state/local government authority (LGA) level that will set national performance standards and serve as a best practice for national and international implementers working to expand IRS.

Specific objectives for 2013 of the AIRS Nigeria program were the following:

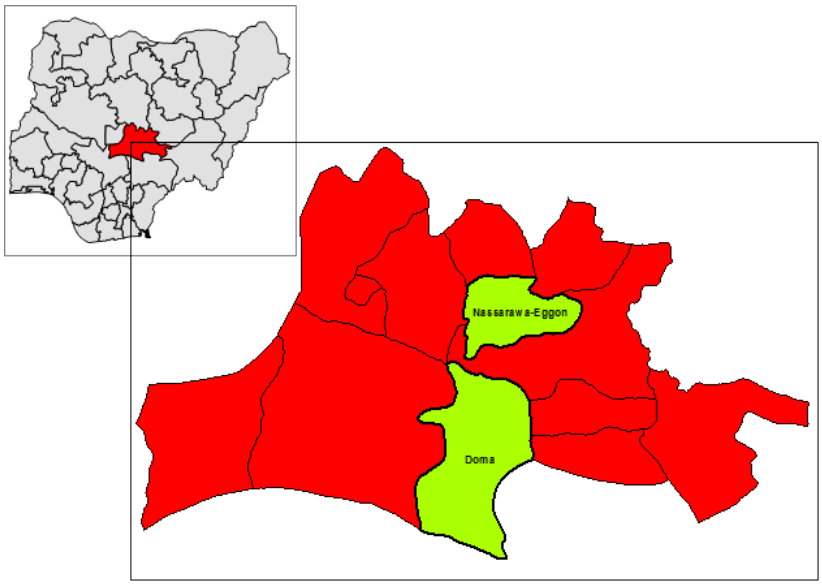
- Achieve spray coverage of at least 85 percent of the total target of 60,000 structures in Doma and Nasarawa Eggon LGAs of Nasarawa State.
- Strengthen capacity at the federal and state level to create evidence-based IRS strategies and to implement IRS, by collaborating closely with the NMCP and states to develop and revise relevant policies, strategies, and guidelines.
- Ensure compliance with environmental regulations and establish local capacity for best practices in the target districts for insecticide handling and usage for IRS.
- Establish effective monitoring and evaluation (M&E) of all activities in order to demonstrate results that can be adapted for possible scale-up of IRS implementation in Nigeria.

PMI and NMCP jointly selected Doma and Nasarawa Eggon LGAs to be the project sites based on the malaria prevalence data and acceptance of IRS by the LGA authorities.

1.2 Spray Sites

Doma LGA, located in the southern part of Nasarawa state (Figure 1), is made up of flat terrain with alluvial fertile soil. Centrally located Nasarawa Eggon is generally hilly and rocky, with numerous rivers and streams that empty into the Benue River. LGAs are divided into electoral wards; Doma comprises 10 wards while Nasarawa Eggon comprises 14 wards. According to the 2006 national census, Doma has a population of 138,991 and a land mass of 2,771.336 sq km, while Nasarawa Eggon has a population of 148,405 and a land mass of 1,237.42 sq km. In the two LGAs, AIRS has established a total of 17 operational centers with soak pits and refurbished stores. It also has a central warehouse in Lafia.

FIGURE 1: MAP OF NASARAWA STATE WITH TWO IRS LGAS



1.3 INSECTICIDE

The selected insecticide for the 2013 spray cycle was from the pyrethroid class. In October 2012, the University of Jos conducted an insecticide resistance study using field – collected wild *Anopheles* mosquitoes in Nasarawa Eggon. Results of the insecticide susceptibility assay carried out on five insecticides from three classes of insecticides are presented in Table 1. There were comparable progressive knockdowns as exposure time increased.

TABLE 1. SUSCEPTIBILITY TEST RESULTS

Insecticide	Class	WHO Tube Test (%)	CDC Bottle Bioassay (%)
Alpha-cypermethrin	Pyrethroid	100	89
Deltamethrin	Pyrethroid	88.46	94
Lambdacyhalothrin	Pyrethroid	84.31	97
Fenitrothion	Organophosphate	100	100
Bendiocarb	Carbamate	100	100

The susceptibility test results showed that all three classes of insecticides can be used for the PMI-supported IRS in Nigeria. *An. gambiae s.l.* was fully susceptible to Bendiocarb and Fenitrothion. The test mortality rates for the pyrethroid class insecticides (Alpha-cypermethrin, Deltamethrin, and Lambdacyhalothrin) were above the 80 percent threshold, ranging from 84 to 100, which is within World Health Organization (WHO) 1998 classification criteria for IRS. A formulation from a pyrethroid class was selected because it lasts longer on sprayed walls than do the other two classes and it effectively covers the long transmission period in Nigeria with one round of spraying. In addition, pyrethroids are environmentally and logistically easier to manage, and their cost is significantly lower than the other two classes.

The NMCP and PMI used the study results together with criteria recommended by the WHO Pesticide Evaluation Scheme to select Deltamethrin as the insecticide for the 2013 spray round.

2. Pre-spray Activities

2.1 Microplanning

The IRS microplanning meeting took place in January 2013. It was facilitated by project staff working closely with officials of the NMCP, the State Ministry of Health (SMOH), and Doma and Nasarawa Eggon LGAs.

The staff prepared a detailed roll-out strategy and action plan containing personnel needs, selection criteria, and logistics and transportation requirements. The participants also decided on the number and location of stores and soak pit sites, quantities for IRS equipment, and training schedule. In order to facilitate a sustainable approach to IRS, the project staff used the event as an opportunity to train the participants from the state and LGA levels on how to gather information for planning the spray campaign and to conduct IRS microplanning meetings.

2.2 Logistics Needs and Procurement

The logistics needs assessment was carried out based on the experience of the 2012 spray operations. A review of the existing stock of materials and equipment in the central warehouse was conducted to determine the items that needed to be procured. The supply planned for the insecticide stock was based on a target of 60,000 structures with a buffer of 20 percent. Two operational centers were added at Rukubi (Agyema) and Alagye (Ruttu) based on the recommendations of the 2012 post-spray conference. Therefore, AIRS prepared a total of 17 stores and 17 soak pits to service the 50 spray teams in the two LGAs. Tables A-1 and A-2 in Annex A present information on commodities procured internationally and domestically, while Table A-3 shows the items dispatched and the returned balance for the 2013 operation in the two LGAs.

The project team refurbished the operational base stores in line with the requirements of the PMI Best Management Practices Manual, and with the needs of the spray teams. Communities contributed to the campaign by releasing the storage rooms for the operation at no cost.

In accordance with the lessons from last year, the team branded and coded all Personal Protective Equipment (PPE) used for the operation with the identification number of recruited field personnel. During the PPE dispatch to each operational base, the team delivered complete PPE sets with identification numbers matching exactly the field personnel assigned to the particular store. This effort prevented equipment mix-ups, ensured accountability of personnel for their individually coded PPEs, improved coordination at each operational site, and simplified inventory reconciliation after the spraying was completed.

AIRS engaged the services of a transportation firm that ensured smooth transportation of field workers and dispatch of commodities from the warehouse to community stores in a timely and safe manner.

2.3 Human Resource Requirements

The project deployed 626 seasonal workers, 16 percent of whom were female, for the IRS operation and mobilization in the two LGAs as shown in Table A-7 in Annex A.

The team conducted recruitment in February 2013. Candidates were nominated by their communities. Those who passed a written exam and the health check attended the trainings. The project added a 6 percent buffer to the number of spray operators invited for training.

An operational team of 50 team leaders coordinated and managed 250 spray operators. Other personnel who supported the operation were 6 supervisors, 2 LGA coordinators, 17 store keepers, 17 pump technicians, 22 washers, 34 security personnel, 2 data assistants, and 10 data entry clerks.

2.4 TRAINING

AIRS Nigeria facilitated 11 types of training (Table 2) for the various categories of field workers and stakeholder organizations' personnel in February and March 2013. A five-day training of trainers (TOT) was conducted for central, state, and local government partners who in turn trained the seasonal workers on the components of IRS. The team arranged for a seven-day spray operator training that took place simultaneously in the two LGAs. Six out of the seven days were dedicated to practical sessions so that the spray operators could master the spray techniques. Other capacity-building events included training for information, education and communication (IEC) mobilizers, health workers, pump technicians, store keepers, washers, drivers, security, and data entry clerks. In total, the project trained 653 persons. Table A-4 in Annex A includes information on key spray personnel trained (MEP indicator 5.1.1) and other personnel trained in IRS including all seasonal workers (MEP indicator 5.1.2.)Table A-5 shows how many personnel were actually hired to do the work.

TABLE 2. CATEGORIES OF TRAINING CONDUCTED

S/No.	Categories of Training
1.	TOT (coordinators, supervisors, team leaders)
2.	Spray operators
3.	Mobilizers
4.	Health workers
5.	Storekeepers
6.	Data entry clerks
7.	Drivers
8.	Washers
9.	Security
10.	Pump technicians
11.	Training of environmental and health officers on IRS enviromental compliance

2.5 ENVIRONMENTAL COMPLIANCE

A supplemental environmental assessment (SEA) was carried out by Research Triangle Institute International in August 2011 and approved by USAID in November 2011. In addition, AIRS prepared a letter report that was approved by USAID prior to the 2013 spray campaign, which covered but was not limited to the following;

- Assessing IRS sites (soak pits, storage rooms, etc.) in order to identify and correct any deficiencies before the campaign;

- Ensuring that personnel are aware of the environmental mitigation and monitoring plan, and that the conditions therein are adhered to during the IRS campaign;
- Ensuring the personal safety of the spray personnel through procurement of PPE and compliance with standard operating procedures;
- Ensuring that the environmental and community impact during and after the IRS campaign is minimized through effective IEC and proper stock management of insecticide;
- Enumerating the random inspections to be performed during the course of the campaign (pre-, mid-, and post-spray);
- Doing a post-campaign inspection to ensure proper closure of operational sites; and
- Providing data justifying the proposal for the class of insecticide to be used for the campaign.

During the pre-spray period, the project did the following to comply with local and international environmental standards and regulations:

- Two additional soak pits were constructed and 15 others were rehabilitated to meet international standards and recommendations.
- Monitoring systems were established to track used insecticide sachets.
- Storekeepers and washers were trained on insecticide safety and mitigation measures.

AIRS Nigeria was one of the first countries to pilot smartphone-based pre-spray environmental compliance assessments. This entailed filling out the forms on site on smartphones and subsequently transmitting the data to readable electronic formats via the Internet. The Nigeria and Angola Abt Environmental Compliance Officers carried out a joint assessment of environmental compliance in all stores and soak pits before spray operations began.

3. Advocacy, Communication, and Social Mobilization

The 2013 IRS campaign was promoted using diverse communication channels. Before spraying started, meetings were held with faith-based organizations (Christian and Muslim), traditional rulers, ward development committees, and all communities in the two LGAs using Community Directed Distributors, volunteer community members who have been trained to assist in health projects at the local government level.

AIRS consolidated pre-spray, spray, and post-spray messages from the 2012 campaign and refined them in partnership with representatives from the Roll Back Malaria information unit within the SMOH, the local media, nongovernmental organizations, and the PMI-funded Malaria Action Plan for States Project. Communication and campaign materials that were deployed included two billboards, fact sheets, T-shirts and caps. These were branded with the PMI logo. Table 3 shows the types and numbers of communication materials produced and distributed for the spray campaign.

TABLE 3. IRS CAMPAIGN COMMUNICATION MATERIALS

Item	No. Distributed
Fact sheet	500
T-shirt	996
Cap	1,000

Table 4 lists major communication and promotional activities carried out. Pre-spray messages were aired on radio in five local dialects and English. In addition, the two paramount rulers in the LGAs endorsed IRS and charged their subjects with cooperating with the spray teams. Mobilizers conducted sensitization and outreach among villagers using interpersonal communication methods. During the actual spraying, mobilizers went ahead of the spray teams to inform the communities of the arrival of the spray operators, and to tell them how they were expected to prepare for spraying. After the community had been alerted, the mobilizers rejoined the spray teams in the previously sensitized communities to help remove household items from the structures before spraying.

TABLE 4. IRS CAMPAIGN COMMUNICATION ACTIVITIES

Activity	Frequency
Meeting with religious leaders (Christians and Muslims)	1
Meetings with traditional rulers	2
Meetings with ward development committees	24
Meeting with all communities	1
Radio spots (pre, during, and after spray)	60
Radio spots (endorsement by paramount rulers)	12
Radio program (interactive show)	1
Newspaper articles	3
Road shows (during flag-off)	2 (1 per LGA)

AIRS Nigeria also had a campaign "flag-off" event in March to officially mark the beginning of the 2013 spray campaign. Representatives from the community, local, state, and federal governments, and the police force attended the event, representing general consent to the start of the IRS campaign.

3.1.1 Pre Spray Mobilization Activity

Mobilizers were recruited to disseminate IRS messages on a house-to-house basis in the LGAs prior to spray operations. The project team recruited and trained 121 mobilizers, 2 mobilization coordinators, and 21 ward supervisors. The sensitization exercise lasted for 20 days. Results of the door-to-door IRS campaign are presented in Table 5. Total number of persons sensitized is lower than covered with IRS because IRS messaging targeted only adults while coverage includes children.

TABLE 5. IRS MESSAGING OUTREACH

LGA	Males Sensitized	Females Sensitized	Total Persons Sensitized
Nasarawa Eggon	59,618	61,187	120,805
Doma	43,137	50,125	93,262
Total	102,755	111,312	214,067

4. Spray Activities

4.1 Spray Operations

IRS operations began in both LGAs on April 11 and lasted for 33 working days. This postponement of the start of the campaign was caused by a three-week delay in clearing the insecticide at the Lagos airport. The delays were due to issues the new supplier had with customs clearance. Daily spray operations took place in all wards simultaneously except for Burum Burum axis of Alagye ward in Doma LGA, where a communal crisis took place simultaneous with the spraying operation. Officials from the NMCP, National Environmental Standards, Regulations, and Enforcement Agency (NESREA), SMOH, and LGAs monitored the spraying. AIRS Nigeria provided the observers with supervisory checklists and data collection verification forms to ensure an objective assessment of the operations. The U.S.-based AIRS Technical Director spent four days in the field monitoring the operations. In addition, a PMI official monitored one day of operation.

The number of spray teams deployed per ward, which ranged from one to five, was based on the population of the ward as shown in Table 6. The maximum number of spray teams per store/soak pit site was eight.

TABLE 6. DISTRIBUTION OF SPRAY TEAMS BY WARD

S/No	Nasarawa Eggon LGA	No. of Spray Teams		S/No	Doma LGA	No. of Spray Teams
1.	Nasarawa Eggon	4		1.	Galadima	5
2.	Alogani	3		2.	Sabon Gari	2
3.	Ogbagi/Agunji	1		3.	Sarkin dawaki	3
4.	Umme	2		4.	Madauchi	1
5.	Kagbu	2		5.	Madaki	1
6.	Lambaga/Arikpa	2		6.	Akpanaja	1
7.	Alushi/Ginda	2		7.	Rukubi	2
8.	Wakama	2		8.	Alagye	3
9.	Ende	2		9.	Abgashi	3
10.	Ubbe/Ogba	1		10.	Doka	2
11.	Iggah/Burum Burum	2				
12.	Mada Station	2				
13.	Ikka/Wangibi	1				
14.	Lizzen/Keffi	1				
	TOTAL	27			TOTAL	23

Spray operations experienced no disruptions due to rainfall. Daily spray activities began at about 07:30 and generally ended at 13:30. However, because the operation coincided with the farming season, spray teams occasionally had to wait beyond 1330 for people to return from the farms and open their homes for spraying. Discipline was enforced among the spray operators and team leaders. Spray operations started in the hard-to-reach areas, which were accessed using motor bikes rather than the regular minibuses, and the movements of the spray teams were guided by customized spray calendars deployed in all operational centers. The team introduced a new way of communication with the spray operators and team leaders, via SMS. AIRS enrolled all the spray personnel in a mass messaging platform and began using text messages to disseminate reminders, reinforce training, and motivate staff. In addition to all staff messages, AIRS segmented different workers by job title and sent them tailored messages to improve their performance. The use of bulk SMS to disseminate information to the field workers played a key role in the supervision of the operations. Data verification was prioritized by supervision teams throughout the operation.

No accidents or injuries were recorded for the duration of the spray exercise. The communities were receptive to the spray teams and testified to the efficacy of the intervention. They were also appreciative of the kind gesture of the U.S. Government in funding the program.

Spray operators collected spray data, and their team leaders collated and verified the data and then deposited them at the stores, which served as operational hubs. The supervisors retrieved the forms from the stores, vetted them, and delivered them to the LGA office from where the data assistants took them to the AIRS office in Lafia on a daily basis.

Supervision and monitoring was prioritized throughout the spray period and included representatives from many government agencies, as shown in Table 7.

TABLE 7. SUPERVISION AND MONITORING BY PARTNERS

Organization	Number of People	Number of Days
PMI	1	1 (Doma)
Abt Home Office	1	2 (Doma), 2 (N Eggon)
World Bank IRS (Anambra State)	3	2(Doma), 1 (N Eggon)
NMCP	4	20 (Doma), 20 (N Eggon)
NESREA	2	20 (Doma), 20 (N Eggon)
Doma LGA	4	20 (Doma)
Nasarawa Eggon LGA	4	20 (N Eggon)
SMOH	3	20 (Doma), 20 (N Eggon)
Federal Ministry of Environment (FMEnv)	2	4 (Doma), 4 (N Eggon)

4.2 Logistics and Stock Management

Commodity logistics management tools were produced to manage and track supplies at every stage of transaction including receiving, inventory keeping, issuing, dispatch, transfer, and utilization.

The AIRS project recruited and trained 17 store keepers to improve their knowledge and skills on operational site management, IRS commodities storage, logistics management, and documentation activities. Seven of them had already worked as store keepers in 2012. All store keepers lived in the communities where the stores were situated. The project distributed insecticides to various stores in the wards and communities according to the projected number of structures to be sprayed. These were dispatched together with PPE and other commodities from the central warehouse in Lafia. At the receiving store site, store keepers checked, counted, and signed the dispatch notes and then released a return copy of the note back to the warehouse as a proof of delivery. Thereafter, the store keepers

used inventory control cards (ICCs) to record the quantities and other details of each item issued or received in the warehouse and all site stores. Because of the importance of insecticides as the main project commodity, a daily insecticides tracking log (ITL) was additionally used to closely monitor total daily amount of the insecticide issued to the spray team, usage (empty sachets returned), and returns (unused full sachets) to each store site at the end of the day. After the day's activity, the store keepers updated the ICC using the summaries of entries from the tracking log by recording the unused returned sachets as positive adjustment on the ICC and any missing sachets on the ICC's negative adjustment column. A stock balance of insecticides was immediately obtained and compared to a physical count, which had to match the ICC stock balance. Further stock control included recording the used sachets on the daily utilization form to obtain the cumulative quantity used at that day of operation. The daily utilization tracking of each store's empty sachets provided information for re-supply of insecticides, and on broad utilization trends.

Store keepers produced mid-operation stock reports and a review was conducted to bring up stock levels of consumable items including insecticides to meet the needs for the remaining period of operation. Accordingly, redistribution from store to store and from warehouse to stores was vigorously carried out using requisition-issue forms and dispatch notes respectively to ensure proper documentation and security of commodities.

Apart from the mid-operation comprehensive stock report, store keepers produced and submitted to the Logistics and Procurement Coordinator reports on the final stock position at each store location at the end of the operation.

4.3 Environmental Compliance Supervision

To ensure that environmental standards and regulations were adhered to, the AIRS project worked closely with the local NESREA office throughout the operation. Environmental compliance inspections were imbedded in the 2013 spray operations supervision and jointly carried out to evaluate mitigation measures. Such measures included proper installation of poison warning signs; proper wearing of PPE; availability of kitted first aid boxes, fire extinguishers, and spill kits in stores; and environmentally compliant soak pits to manage the effluent waste generated before and after the daily activities.

The spraying personnel followed the safety rules regarding proper wear of PPE. There were no spills of insecticides observed during the supervision visits, and the human and environmental exposure to insecticides was within the norms. There were no adverse health situations reported as a result of insecticide usage.

The inspecting teams were satisfied with the environmental compliance practices and measures in place and the general practice in the field. There were no reported serious issues or adverse events associated with the spray exercise. The Mid-spray EC report is provided in Annex B.

5. Post-spray Activities

5.1 Closing of IRS Operations

The 2013 IRS operations officially ended on May 18. AIRS project held the post-spray conference in Lafia on May 28. Participants included representatives from the NMCP; the SMOH led by the Deputy Director of Public Health, Nasarawa State; Doma and Nasarawa Eggon LGAs; NESREA; and selected members of all categories of field staff.

The focus of the conference was to report results, document challenges encountered during the spray operations, discuss lessons learned, and make recommendations for future spray operations. The best-performing field workers received recognition awards.

The meeting agenda had two core sections: a plenary session with presentations by all categories of participants, and then breakout meetings for eight working groups. During the breakout sessions, participants discussed the following topics:

- Recruitment of IRS personnel
- Effective community mobilization
- Ensuring good quality of spray
- Consistently meeting spray targets
- Maintaining good quality of spray data
- Adhering to environmental/safety standards
- Motivation of the spray team
- Sustainability of IRS in Nasarawa State

The overall view was that the spray campaign was successful and worked better than the 2012 exercise. There is, however, the need for more commitment on the part of the SMOH to take over project responsibility as the project ended with this spray round.

5.2 Post-spray Communication Activities

Post-spray radio messages were aired to remind the communities of the need to avoid behaviors that would negate the spray campaign such as repainting, re-plastering, and covering the sprayed walls with objects. The messages were broadcast in six languages, 30 spots in total three times per day for 10 days after spray.

5.3 Demobilization

Following completion of spray operations, the project team moved insecticides from the 17 operational centers to the central warehouse in Lafia. The team also transported used insecticide sachets, used disposable nose masks, respirators and air filters, pumps, and other commodities to the central warehouse. Progressive rinsing barrels and washing buckets were collected and put in storage in the central warehouse.

The team packaged solid wastes from the campaign in WHO-recommended yellow bin liners. In total, 168.9 kg of waste including the bin liners was prepared for the incineration.

A post-spray environmental compliance assessment was completed and documented (Annex C). The safety signs at the soak pit sites remain in place. There is no evidence of contamination in the area.

5.4 Reverse Logistics and Commodities Reconciliation

At the end-of-spray campaign across the operational centers, store keepers recovered all reusable materials and equipment from all field staff after the items had been washed and cleaned thoroughly. The insecticide stock dispatched to sites including the buffer was completely consumed in the spray operation, bringing the stock to zero in most operational sites. All other commodities – used insecticide sachets, pumps, PPE, and so forth – were packed together by category. The project hired a transportation firm to move the items from the sites back to the central warehouse. This included securely loading them in enclosed buses that the store keepers then accompanied to the warehouse.

Quantities of items received from each store keeper were compared to issued/dispatched quantities to each store during the period of operation. Any discrepancy observed was reconciled after the store keeper physically showed the damaged items in the right quantities. The warehouse store keeper signed off on all reconciled issue-receipt notes from operational site store keepers. The Logistics and Procurement Coordinator reviewed the notes and ascertained that operational sites had been cleaned of wastes. After concurrence from the warehouse store keeper, the store keepers were cleared for final payment. Then, the warehouse store keeper physically counted and orderly arranged all goods by category in the central warehouse for storage. The quantities of each type of equipment and materials received were entered on the respective ICC to update the project inventory records. Table A-3 shows the 2013 post-spray inventory maintained in the central warehouse for the project.

5.5 Incineration, Final Disposal, Soak Pit Security

In line with SEA recommendation on incineration of IRS solid waste, the project used the incinerator at the National Institute of Pharmaceutical Research and Development (NIPRD), Idu Industrial Estate, Abuja, for the incineration of the wastes and final disposal of the incinerated bottom ash. The incineration certificate is attached in Annex D. After incineration, the resulting ash was fixed/ encapsulated to immobilize the hazards contained therein according to local environmental compliance regulations.

Given that the AIRS project will not carry out spray operations in 2014 and after, the team is planning to cover the soak pits with metal/concrete slabs. This will be done in September after the rainy season. The slabs will prevent excess filtering/washing of degrading materials hence the longer stay/duration of the soak pits. The wire gauze will be maintained and will restrict unauthorized people from entering the area.

5.6 Strengthening Performance Standards and Capacity

As part of the objective to establish a model IRS program at a state/LGA level, the AIRS project introduced environmental compliance procedures for the soak pits, store facilities, and M&E protocols including definition of structure for IRS implementation in Nigeria.

LGA and state-level authorities acknowledged the benefits and value of the new standards, which have been accepted by the NMCP. By actively engaging local and central authorities in the IRS micro-planning and training, the project introduced requirements and standards for the operational task force and managerial expertise essential for implementation of IRS.

6. ENTOMOLOGY

The AIRS project worked closely with the NMCP Integrated Vector Management Unit to provide entomological monitoring. One hundred and nineteen entomology technicians and mosquito collectors drawn from the two intervention LGAs and control LGA (Lafia) were recruited and trained for baseline data collection and other entomological monitoring activities. For monitoring vector behavior, density, composition, and seasonality, the project selected three sentinel sites (Doma, Nasarawa Eggon, and Lafia LGAs), one in each intervention LGA and one in a comparable site in the control LGA.

6.1 NATIONAL ENTOMOLOGICAL TRAINING

The project organized a national training for 37 vector officers and entomology technicians drawn from 36 states and the Federal Capital Territory. The training is part of the capacity-building objective of the PMI | AIRS project. The five-day training was held in Abuja in February 2013. The training agenda included:

- Current measures in malaria control
- The role of entomology in the control of malaria
- Planning for malaria vector control
- Identification of adult *Anopheles* mosquitoes
- Identification of eggs and larvae of malaria mosquitoes
- Ovarian dissection
- Insecticide resistance mechanisms
- Raising mosquito colonies and insectary operations
- Entomological surveillance

Facilitators at the training were drawn from the Nigeria Institute for Medical Research, Yaba, Lagos; University of Illorin, Kwara State; the Institute for Advanced Medical Research and Training, College of Medicine, University of Ibadan, CDC and Abt Associates.

6.2 MONITORING VECTOR DENSITY, DISTRIBUTION, SEASONALITY, AND BEHAVIOR

The first entomological data collection on vector density, distribution, seasonality, and behavior, which provided a baseline, was completed before the spraying began. Subsequent post-spray entomological monitoring activities will be conducted monthly for six months.

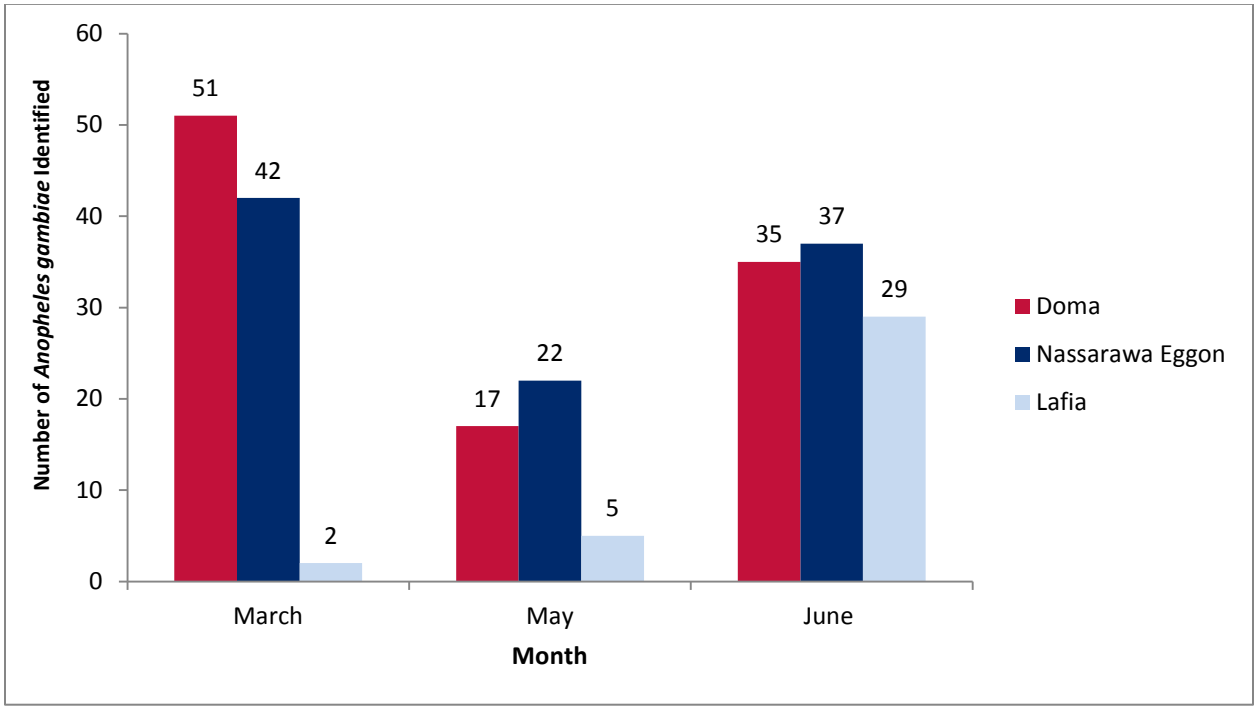
6.2.1 PYRETHRUM SPRAY COLLECTION

The Pyrethrum Spray Collection method as described by WHO (1975) was used to sample indoor-resting mosquitoes for the baseline, one month before spraying began. The houses/ huts were sprayed systematically by two people using Rambo insecticide (0.50 Dichlorvos, 0.20 percent Permethrin, 0.15 percent Transfluthrin), one inside, and the other outside the hut. The two persons began spraying at the

same time, and simultaneously moved in opposite directions, after which the door was closed and opened only after 15 minutes to collect mosquitoes.

A total of 511 adult mosquitoes were collected in all LGAs sampled during the month of March 2013. Of these, 95 (18.6 percent) were *Anopheles gambiae s.l.* and 416 (81.6 percent) were *Culex* species. In May, 393 mosquitoes were collected; 44 (11.2 percent) of the mosquitoes caught were *Anopheles gambiae s.l.* and 349 (88.8 percent) were *Culex* species. Of the 309 mosquitoes caught in June, 101 (32.7 percent) were *Anopheles* species while 208 (67.3 percent) were culicines. There was a remarkable reduction in the resting density of the mosquitoes after the intervention despite increase in rains. There was a significant difference in the resting density of mosquitoes before and after the IRS intervention (χ^2=35.971, df = 1, p<0.0001)
(Figure 2).

FIGURE 2. INDOOR RESTING DENSITY OF ANOPHELES MOSQUITOES, MARCH–JUNE 2013



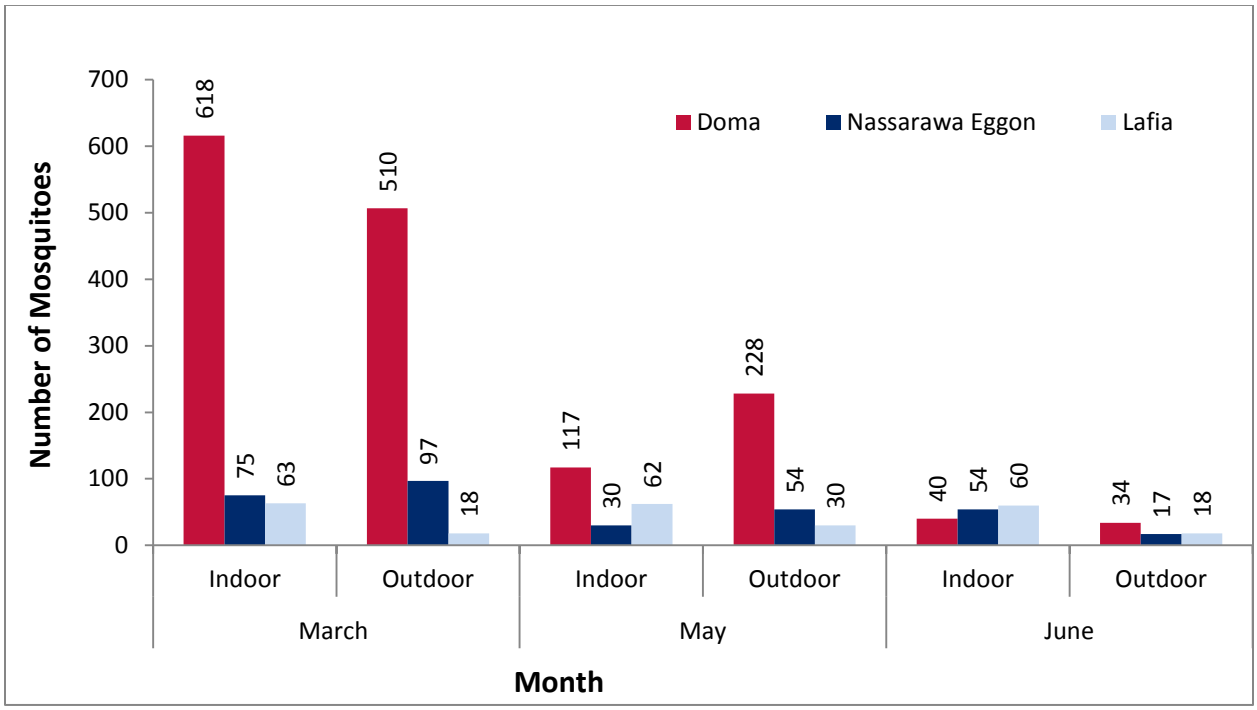
6.2.2 Human Landing Catches

The biting activities of the anopheline were monitored over four nights. A total of 72 mosquito collectors and 18 supervisors were involved in the Human Landing Catches (HLC). For the HLC, three communities were randomly selected in each of the intervention sites and the control LGAs; two structures were selected per community for a total of 18 structures. Teams consisted of two mosquito collectors stationed inside and outside of each selected sleeping structure per community. Mosquitoes were captured by manual aspiration using aspirators and flashlights. They were caught as they attempted to bite the collectors. To avoid risk of malaria infection, the collectors were provided with Artemisinin-based Combination Therapy (Coartem), an anti-malaria prophylaxis, according to a WHO-recommended regimen. Hourly collections, kept in separately labeled paper cups, were provided with a sugar solution until identification and dissection for parity (Fornadel *et al.*, 2010).

Collections were carried out between 18:00 and 06:00 hours inside and just outside two structures per community in three communities of each LGA. Informed volunteers who gave prior informed consent carried out the HLCs. At the end of every hour, the indoor collectors switched positions with those outside. The activity level of the vector throughout the night was assessed by paired indoor/outdoor HLCs.

A total of 2,217 mosquitoes were caught both indoors and outdoors in the intervention and control areas in March. Of these, 1,309 (59 percent) were *Anopheles gambiae s.l.,* 3 (0.1 percent) were *An. funestus,* 2 (0.1 percent) were *An. squamosus,* 1 (0.1 percent) was *An. coustani,* and 902 (40.7 percent) were *Culex* species. In Doma, 618 *Anopheles gambiae s.l.,* were caught in March and 117 were caught in May (Figure 3). In Nasarawa Eggon, 75 were caught indoors in March and 30 were caught indoors in May. There was a significant difference in the *Anopheles'* biting pattern indoors and outdoors in Doma (χ^2=20.733, df=1 p<0.0001), Nasarawa Eggon (χ^2=5.128 df=1 p=0.0235). There was however no significant difference in the *Anopheles* biting pattern in the control area (χ^2 =1.286 df=1, p=0.2568). This shows that the IRS intervention had a strong impact in the intervention areas when compared to the control area. Four anopheline species (*An. funestus*, *An. squamosus, An. coustani* and *An. gambiae s.l*) were the predominant species within the two intervention and control areas (Figure 3).

FIGURE 3. NUMBER OF ANOPHELES SPECIES USING HUMAN LANDING METHODS, MARCH–JUNE 2013



6.2.3 Host-seeking Behavior, Feeding Preferences, and Biting Cycles

At the baseline, the mean numbers of bites per person per night (bpn) indoors and outdoors in both intervention areas were not significantly different (P=0.12 and P=0.53); in contrast, the difference between indoor and outdoor biting in the control area was statistically significant (P<0.0001). Peak biting time across intervention and control areas varied but was mainly between 0200 and 0400.

In Doma, the Man Biting Rate (MBR) for the month of March was found to be 77.3 bpn indoors and 63.8 bpn outdoors. There was, however, no significant difference between the biting pattern indoors and outdoors (χ^2 =2.04 ,df =1 ,p=0.12). The MBR in Nasarawa Eggon was 9.4 bpn indoors and 12.1 bpn outdoors; these were also not statistically significant (χ^2 = 0.381 ,df =1 p =0.53); in Lafia, the MBR was 7.9 bpn indoors and 2.3 bpn outdoors, highly significant.

In May, after the IRS intervention, the MBR in Doma decreased to 14.6 bpn indoors and 28.5 bpn outdoors. There was also a marked reduction of MBR in Nasarawa Eggon to 3.8 bpn indoors and 6.8 bpn and outdoors. The mean number of bpn was significantly different for *An. gambiae* between the two LGAs but there was no significant difference in indoor and outdoor bites per night, as shown in Table 8.

TABLE 8. MBR OF *ANOPHELES* MOSQUITOES, MARCH–JUNE 2013

LGA	Month	Time of Collection	Number of Collectors per Night		Number of Collection Nights	Total number of Female *An. gambiae s.l.* Collected		MBR (number of *An. gambiae s.l.* per collector per night)		P -Value
			Indoor	Outdoor		Indoor	Outdoor	Indoor	Outdoor	
Doma	March	6pm to 6am	2	2	4	618	510	77.3	63.8	P=0.12 **NS
N.Eggon	March	6pm to 6am	2	2	4	75	97	9.4	12.1	P=0.53 NS
Lafia	March	6pm to 6am	2	2	4	63	18	7.9	2.3	P<0.0001 *S
Doma	May	6pm to 6am	2	2	4	117	228	14.6	28.5	P=0.108 NS
N.Eggon	May	6pm to 6am	2	2	4	30	54	3.8	6.8	P=0.39 NS
Lafia	May	6pm to 6am	2	2	4	58	30	7.3	3.8	P=0.39 NS
Doma	June	6pm to 6am	2	2	4	40	34	5	4.3	P=0.8NS
N.Eggon	June	6pm to 6am	2	2	4	54	17	6.8	2.1	p=0.05NS
Lafia	June	6pm to 6am	2	2	4	60	18	7.5	2.3	P=0.02 S

*S=Significant; **NS = Not Significant

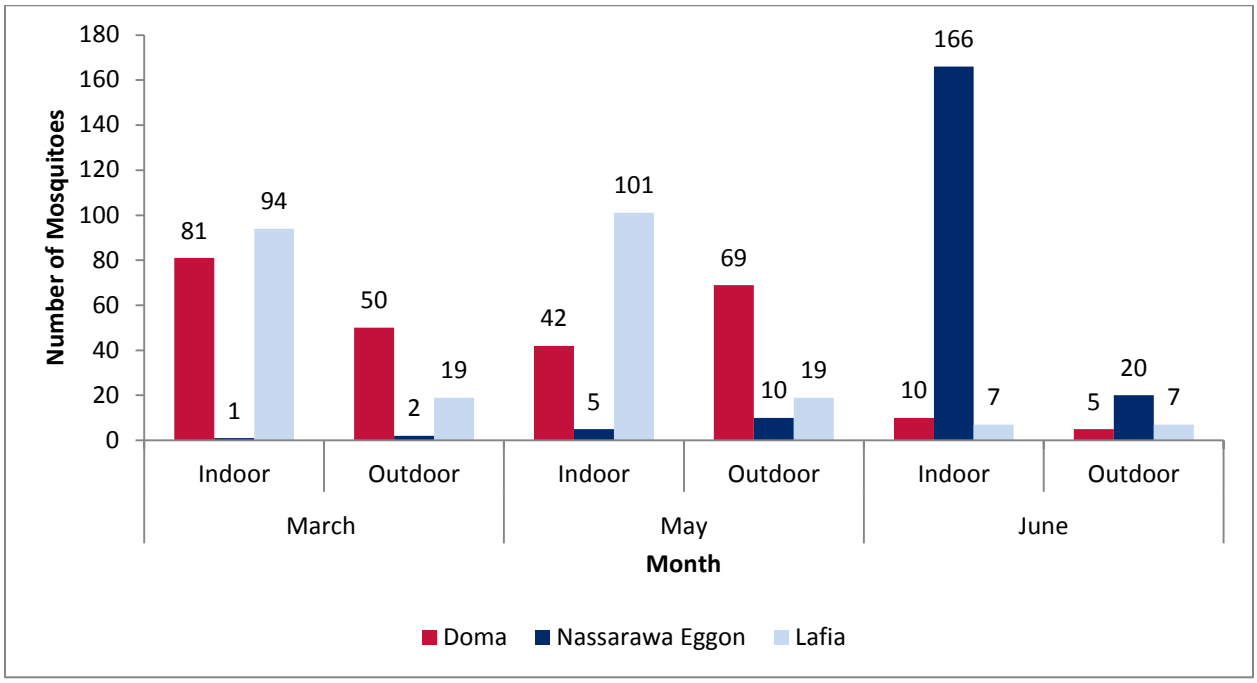
6.3 CDC Light Trap

Human-baited CDC light traps were used to collect mosquitoes. In such a system, one person (a "sleeper") sleeps alone in a house overnight. An indoor CDC light trap fitted with an incandescent bulb is installed about 1.5 m above the floor next to the foot of the bed (or other usual sleeping place) where the human volunteer sleeps under an untreated mosquito bed net. The light trap attracts female anophelines that have entered the room to bite. A second light trap is positioned outdoors, not more than 5 meters from the sleeping structure. Trapped mosquitoes are removed the next morning according to methods described by WHO (2003).

Twenty-four CDC light traps were deployed in study houses in the intervention and control areas (eight traps per LGA). Four houses were selected in each of the intervention LGAs and the control. Two light traps were placed per house (one indoors and one outdoors). Study houses were selected in areas where HLC was going on because the areas either had provided abundant mosquitoes in the past or were in close proximity to breeding sites. In each LGA, eight structures were used to evaluate vector trapping methods before the IRS spraying operation and one month after the intervention. Such sampling will be done monthly for six months total including the baseline.

A total of 131 *Anopheles* mosquitoes were trapped in Doma in March. Of these, 81 (61.8 percent) were caught indoors and 50 (38.2 percent) were caught outdoors. In May, this decreased to 42 (37.8 percent) indoors and 69 percent outdoors. As these numbers show, more mosquitoes were caught outdoors after the intervention. In June, 10 *Anopheles* mosquitoes were caught indoors in Doma, 166 in Nasarawa Eggon (this in part could be attributed the increase in the rains), and seven in Lafia while fewer mosquitoes were caught outdoors in the three LGAs compared to indoors. (Figure 4).

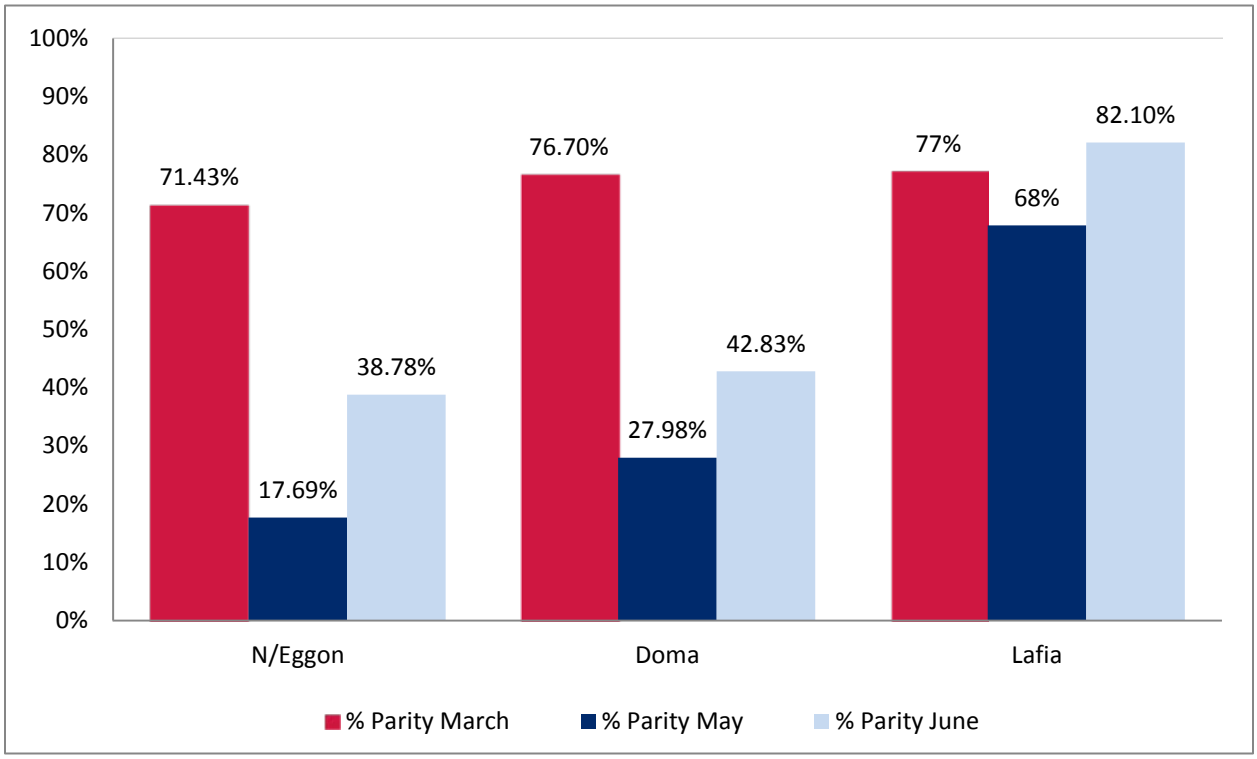
FIGURE 4. NUMBER OF *ANOPHELES* SPECIES CAUGHT USING CDC LIGHT TRAP, MARCH–JUNE 2013



6.3.1 Parity Rate

The ovaries of the (female) *Anopheles* mosquitoes caught during HLC were dissected for physiological age grading and parity rate determination using WHO-recommended techniques (Detinova 1962). Of all the female *Anopheles* mosquitoes dissected before the IRS intervention in March, 84 were from Nasarawa Eggon, 130 from Doma, and 83 from the control area. Parity rates of 71.43 percent, 76.70 percent, and 77.25 percent were established at baseline in the respective areas. One month after the intervention (May), parity rates fell to 17.69 percent in Nasarawa Eggon and 27.98 percent in Doma, while they remained as high as 67.9 percent in the control area. In June, a slight increase in the rate was observed in the intervention areas (38.78 percent and 42.83 percent in Nasarawa Eggon and Doma, respectively); in the control area, the percentage rose to 82.10 percent (Figure 5). This shows that the insecticide can be considered at this stage to be effective, responsible for considerably lowering the number of infectious *Anopheles* mosquitoes in the intervention areas. In particular, there was a sharp increase of nulliparous mosquitoes observed in the two intervention areas whereas parous mosquitoes outnumbered the nulliparous ones in the control area (Figure 6). If residual spraying is effective, there will be fewer parous mosquitoes than nulliparous mosquitoes after spraying than before spraying. In non-treated areas, parous mosquitoes should outnumber nulliparous mosquitoes (WHO 2003), as was seen above.

FIGURE 5. PERCENTAGE PARITY OF FEMALE *ANOPHELES* MOSQUITOES, MARCH–JUNE 2013



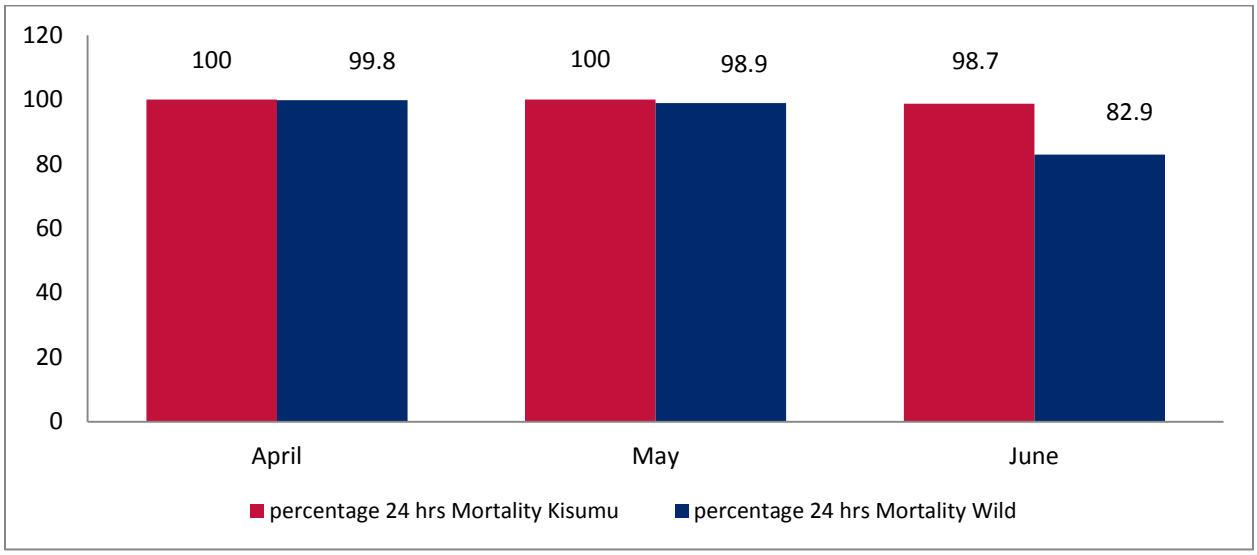
6.4 Cone/Wall Bioassay Tests

6.4.1 Determination of Quality of Spraying and Persistence

The quality of spraying and residual efficacy of insecticide on the walls was tested using the standard WHO cone bioassay. For these bioassays, a 3–5 day-old susceptible laboratory strain *An. gambiae* (Kisumu strain) and 3–5 day-old females of the field-collected mosquitoes (larvae reared in the insectary) from the study villages were used. A total of 10 treated structures were tested with susceptible strains and 21 structures with field-collected mosquitoes. For the assay, WHO plastic cones lined with self-adhesive packing were fixed on the sprayed walls in randomly selected houses. A batch of 10 female *Anopheles* mosquitoes was exposed to the insecticide for 30 minutes at different cone heights (0.5m, 1.0m, 1.5m, and 2.0m). These were collected in paper cups covered with nylon net fastened with a rubber band till the 60th minute and knockdown times at 30 and 60 minutes (KD30 and KD60) were recorded. The mosquitoes then were fed with a 10 percent sugar solution soaked in cotton wool, and the percentage mortality was calculated and recorded per test cone for each house after 24 hours. Where a mortality of 5–20 percent was observed in the control test, correction mortality was calculated using Abbott's formula. The test was carried out in Nasarawa Eggon and Doma 24 hours after spraying and then one month after. This will be done monthly for six months to measure the residual efficacy of the insecticide.

A total of 31 treated structures from Nasarawa Eggon and Doma LGAs were tested. Results show that the average 24-hour mortality of susceptible strains was 100 percent in April and May, whereas the mortality rates of wild mosquitoes were 99.8 percent and 98.9 percent for the two months. In June, the insecticide decay decreased mortality to 98.7 percent with susceptible strains and 82.9 percent with wild strains. There was no statistical difference in the mortality rates between the Kisumu strains and wild strains in the month of April ($\chi 2 = 0.001$, df=1 ,p=0.97) or May ($\chi 2= 0.081$, df=1, p=0.77). However, there was a significant difference in the month of June ($\chi 2= 27.15$, df=1, $p<0.0001$) (Figure 7).

FIGURE 7. WHO CONE BIOASSAY RESULTS, APRIL–JUNE 2013



7. Monitoring and Evaluation

7.1 Key Objectives and Approach

AIRS Nigeria identified lessons learned from the 2012 spray operations and made improvements to the M&E system for the 2013 campaign to:

- Emphasize accuracy of both the data collection and the data entry processes through comprehensive trainings and supervision at all levels;
- Streamline and standardize data information flow to minimize errors, and facilitate timely reporting and use of data for effective and better IRS operations; and
- Ensure IRS data security and storage for future reference through establishment and enforcement of proper protocols.

7.2 Data Collection

The data collection closely followed the process described in the country work plan. The project employed 10 data entry clerks to enter mobilization and spray data from operations in Doma and Nasarawa Eggon LGAs. The project continued to use the 10 laptops procured in 2012 and installed the AIRS Nigeria database on each of them. The networking access built into the database, which used the Microsoft Access program, was able to provide automated real-time updates of spray progress reports both locally and at the AIRS Home Office. The electronic data were backed up onto a web-based server each day. Server backup was scheduled to run each day to capture incremental changes; a full backup was done each week.

7.3 Data Quality Assurance

7.3.1 Data Collection/In-Field Verification

Data quality assurance activities were instituted for both data collection and data entry verification through newly developed supervisory tools and the standard database audit checks. Our data quality assurance efforts significantly reduced the number of errors found on *Daily Spray Operator Forms* and in the M&E database, improving the overall quality of the data and IRS results.

Error Eliminator

AIRS senior management, supervisors, team leaders, and government staff (federal, state, and local) used the Error Eliminator (EE) daily to detect and correct common errors on mobilizer and spray operator forms before they were transported to the data center. Common errors included arithmetic mistakes and failure to complete all data points on the data collection forms.

Data Collection Verification Form

AIRS senior management, supervisors, and government staff (federal, state, and local) used the Data Collection Verification (DCV) tool to interview households to verify spray coverage data. Staff visited and interviewed residents from 12,978 structures (20.2 percent) during the campaign. Common data collection inconsistencies were due primarily to a variance in the population-protected count. However, staff performed these verification visits within approximately two days of spray and identified errors in

enough time to correct mistakes and notify spray operators and team leaders via SMS to prevent repeat errors.

7.3.2 Data Entry Verification

Data Entry Verification Form

The M&E and Database Managers used the Data Entry Verification tool to verify that the data entered into the database matched the data on the Daily Spray Operator Forms. They found far fewer errors this year compared to last year as a result of the in-field supervisory verification tools (i.e., EE and DCV tools) and the new database data cleaner that was programmed and installed before the campaign began. A total of 766 lines/structures (1.2 percent) were checked in the 'details' section and also the corresponding 'totals' sections. Out of these, errors were detected in only 12 lines/structures (1.6 percent). These errors were corrected and the data entry clerk was re-trained if required.

Access Database Audit Locks and Data Cleaner

In addition to the database validation rules (e.g., the number of pregnant women in the structure cannot exceed the number of women in the structure), AIRS Nigeria provided each data clerk with their own data cleaner tool that they used to run error reports and correct data entry mistakes each day before leaving the office. Data were entered and cleaned "real-time" (within 24 hours of spray) because the AIRS project hired a sufficient number of data clerks and gave each of them time to clean their data daily.

7.4 Spray Results

All AIRS Nigeria performance indicators are presented in a Monitoring and Evaluation Plan matrix in Annex E. Details of some key IRS indicators such as number of structures sprayed, people protected and insecticide-treated net availability and use are provided in the following sections of the report.

7.4.1 Spray Data

The total number of structures found by spray operators was 64,191 (31,779 in Doma and 32,412 in Nasarawa Eggon) and the number of structures sprayed was 62,592 (31,141 in Doma and 31,451 in Nasarawa Eggon). With that, the overall spray coverage is 97.5 percent as shown in Table 9.

TABLE 9. IRS COVERAGE: PERCENTAGE OF ELIGIBLE STRUCTURES SPRAYED IN TARGETED AREAS

Indicators	Doma	Nasarawa Eggon	Total
No. of structures found by spray operators	31,779	32,412	**64,191**
No. of structures sprayed	31,141	31,451	**62,592**
Spray coverage (%) (based on structures found by spray operators)	98.0	97.0	97.5

7.4.2 Population Protected

The total population protected by IRS in 2013 is 346,798, including 170,885 (49.3 percent) females and 175,913 (50.7 percent) males as shown in Table 10. Of these, 67,204 children under the age of five years and 16,733 pregnant women were protected.

TABLE 10. POPULATION PROTECTED

	Male	Female	Total	Pregnant Women	Children <5 years
Doma	96,356	91,340	187,696	10,030	40,403
Nasarawa Eggon	79,557	79,545	159,102	6,703	26,801
Total	175,913	170,885	346,798	16,733	67,204
Percentage (%)	50.7	49.3	100.0	4.8	19.4

7.4.3 Insecticide Consumption and Mosquito Net Use

A total of 40,000 insecticide sachets were issued to spray operators and 39,995 were used to spray 62,592 structures. On average, one sachet covered 1.6 structures, and spray operators sprayed 7.7 structures per day. The stock balance at the end of the campaign was four unused sachets, and one damaged sachet.

Additionally, households reported having 76,166 available mosquito nets with 10,631 pregnant women and 32,226 children under 5 years sleeping under a net the previous night (Table 11).

TABLE 11. MOSQUITO NETS REPORTED AVAILABILITY AND USE

LGA	ITNs Reported Available	Reported Net Use by Pregnant Women	Pregnant Women Protected by IRS	Reported Net Use by Children <5	Children <5 Protected by IRS
Doma	30,465	5,443	10,030	15,156	40,403
Nasarawa Eggon	45,701	5,188	6,703	17,070	26,801
Total	76,166	10,631	16,733	32,226	67,204

7.5 Post-Spray Data Quality Audit

This section documents an M&E activity that was implemented mid-way between the 2012 and 2013 campaigns and, therefore, the results were not completed until after the submission of the 2012 AIRS Nigeria End of Spray Report. AIRS Nigeria led an internal post-spray audit to validate the spray coverage and the percentage of people protected during the 2012 IRS campaign reported by AIRS Nigeria. Through a three-stage sampling design, the project selected a representative sample and surveyed 487 eligible structures in the two target LGAs. The project assembled two teams of AIRS Nigeria and LGA staff that included five surveyors and one supervisor. Data collection started on October 1, 2012, roughly four months after the end of the IRS campaign, and lasted eight working days.

Mobilization audit data found that 95.5 percent of sampled structures (n=465) reported a visit by an IEC mobilizer during pre-spray campaign activities. Of these, 57 percent (n=278) could present their IRS card. AIRS Nigeria believes some eligible structures were not mobilized before spray because of communal clashes that prevented AIRS staff from accessing these communities. Additionally, mobilizers not recruited directly from their own community reported unfamiliarity with the area, which may have led to under-reporting eligible structures later found by spray operators.

Spray coverage audit data show that 97.5 percent of structures were sprayed compared to the 99.1 percent coverage reported in the 2012 EOSR. Without a statistically significant difference (p-value =0.05) between the two spray coverage calculations, we can conclude that the actual spray coverage is *lower* than what was reported for the 2012 campaign. However, the spray coverage estimates from the audit and the 2012 IRS campaign are well above the 85 percent project goal. Furthermore, audit data report that 98.7 percent of people were protected compared to 99.4 percent noted from the 2012 campaign. Based on a 95 percent confidence interval, we are statistically confident that the reported proportion of people protected during the 2012 campaign reflects the true proportion of people protected across the two LGAs.

In discussion, the 2012 IRS campaign was the first of its kind in Nigeria. As with any new project, the team faced data collection and entry challenges that have been addressed for future campaigns. AIRS Nigeria emphasizes the importance of instituting data verification checks (via the AIRS Supervisory Toolkit) by supervisors and the AIRS M&E team to reduce data errors during the next campaign. Additionally, IRS programs should scale up IEC door-to-door messaging before spray to educate communities on the benefits of IRS, and to dispel IRS myths and allay fears. Reportedly, despite high IRS acceptance rates in Nigeria, several households exhibited dissatisfaction with IRS by throwing out their IRS cards because of disappointment with the insecticide's ineffectiveness. Finally, AIRS Nigeria recommends continued collaboration with government staff on additional post-spray audits and other IRS activities to build local capacity and promote program sustainability.

8. Finance and Payment Strategies

The finance unit worked very closely with operational and M&E teams. The latter created a very efficient and precise database used in monitoring field workers' identities and daily attendance. This drastically reduced the challenges of managing payments of the field staff.

Payment by bank draft was deployed in the 2013 spray round as a result of the different modes of payment tested in the 2012 spray round, which showed that payment by bank draft was remarkably effective for IRS field workers' payment. Field workers were adequately informed about the payment schedule and payment method during their trainings. During the campaign, the user-friendly, web-based SMS messaging interface allowed the team to disseminate information on a real-time basis to targeted recipients. Succinctly written messages with the mobile telephone numbers of intended recipients in a prescribed format were sent by email to the service provider, who then placed the numbers on their bulk SMS web platform for dissemination. The team confirmed message delivery by telephone with the supervisors in the field. This system provided mutual understanding and unanimous acceptance of proffered payment terms. The first payment was for the first 10 working days; the balance was paid at the end of the spray operation or mobilization. All payments were made in a timely manner.

9. Lessons Learned and Challenges

1. **Post-field technical review meetings**: These meetings were held every other day and proved invaluable to the success of the IRS operation.
2. **Difficult terrain and poor road network:** Reaching some communities, particularly those in the hills, was challenging. Travel entailed using a combination of motorcycles and extended trekking.
3. **PPE:** The re-usable nose masks were changed to the disposable N95 type, which proved to be preferable for the safety of the spray team members.
4. **Uncooperative attitude:** Some householders were reluctant to move their property outside even when mobilizers and spray operators were willing to assist. This was commonly observed with householders that had many possessions.
5. **Supervision:** The detailed supervision strategies that were used helped to identify cases of irregular data entry in the field and provide prompt solutions.
6. **Bulk SMS:** This proved to be a most useful means of communicating with the spray teams in order to correct, re-enforce, and motivate performance.
7. **Communal clashes:** Clashes in the Burum Burum axis of Alagye ward in Doma LGA prevented spray operations from taking place there.
8. **Operational center:** An extra operational center would have been required for an axis in Doka ward, Doma LGA. This is because of the extensive landmass of Doka ward and the poor road network in the farthest parts of the ward.
9. **Insectary set-up:** Setting up the insectary in Keffi town and stabilization of susceptible (Kisumu) strains of *Anopheles gambiae s.s.* posed some challenges. This was because it is the first time that Kisumu strains have been reared in North-central Nigeria and the high humidity and temperature posed an initial challenge.
10. **Customized spray calendars:** The use of customized spray calendars by team leaders and store keepers played a key role in the implementation of the 2013 spray cycle. The spray calendar is an operational chart that shows the communities to be covered by the spray teams on a daily basis. It therefore guides both the spray teams and supervisors. It was customized by the operations team to include the means of transportation to each community as well as the number of structures in that community.

10. RECOMMENDATIONS

Because PMI is ceasing funding for the AIRS-led IRS operations in Nigeria in Nasarawa state, this report ends with some general recommendations for IRS in the future. Increasingly,over the course of the two years of full-force spray campaigns in Nasarawa state, the project established a positive perception toward IRS among beneficiaries as well as state- and district-level implementers. The expertise that AIRS built among the LGA officers should be used for similar efforts in other states and at the national level. The supervision strategy developed for this year's operations, which placed representatives from various government agencies in observation teams, proved to be a successful element of the campaign because it ensured compliance with environmental standards and quality performance. The NMCP should adopt this strategy in the future. Similarly, the M&E database that was upgraded with additional features this year should be transferred to the NMCP and AIRS team should coach NMCP colleagues in its use and maintenance. The NMCP should use most of the soak pits constructed for the AIRS spray campaign as examples that follow international standards of environmental compliance.

In the past two years, the AIRS Nigeria team developed high-level expertise in planning, preparing, and executing IRS campaigns. The NMCP and other agencies and organizations in Nigeria interested in learning about and conducting IRS should leverage the team's knowledge and experience in order to carry out their own successful campaigns.

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ANNEX A

TABLE A-1. 2013 INTERNATIONAL PROCUREMENT INVENTORY

Item Description	Qty	Item Description	Qty
CDC light traps set	40	Deltamethrin insecticide sachets	40000
6V battery	24	Helmet	40
Automatic charger for 6V batteries	5	Face shield	180
Insecticides impregnated papers with control	192	Brackets	70
Adult mosquito diagnostic kit	8	Long gloves-pairs	9
Bioassay kit	8	Spare parts kit-packets	21
Aspirator –(straight)	80	Cellular phones	2
Aspirator- (bent)	12	Paper cup	2000

TABLE A-2. 2013 LOCAL PROCUREMENT INVENTORY

Item Description	Qty	Item Description	Qty
		M&E data collection form	30000
Dissecting microscope-Olympus	1	Electronic timer clock	3
Small dissecting microscope	2	Egg tray–petri dish	36
Silica gel- 500g	3	Distiller–glass	1
Grinding mortar and pestle	2	Room heater	2
Aluminium washing basin	1	Self-indicating silica gel	7
Plastic bowls 20L	5	Eppendorff tubes–pack of 500s	15
Plastic buckets 20L	5	Automated lighting system	1
Electronic weighing balance	1	Thermohygrometer	1
Duran bottles–100ml	50	IEC materials (T-shirts)	996
Duran bottles–200ml	50	IEC materials (face caps)	1000
Duran bottles–500ml	50	Liquid washing soap–20 L jerry can	36
Duran bottles–1000ml	50	Cotton socks–pairs	710
Larvae screen–small size	10	Towel	350
Larvae screen–medium	24	Lux soap–tablets	2070
Larvae screen–large	24	Gum boots–pairs	38
Adult cage–medium	24	Rubber hand gloves (pairs)–red	154
Adult cage–large	24	Jug 2–L	23
Adult cage–small	24	Jerry can–20 L	12
Jerry can–50L	2	Drum–200 L	17
Insulator cups	60	Drum–100 L	16
Water reservoir cans 25 L	2	Basin–40 L	8

Item Description	Qty
Dissecting kits	2
Humidifier	2
Disposable pipette	5
Standard hot plate (heat block)	3
Cotton wool 500g	6
Filter paper	10
Cover slips	2
Ethanol–2 L	1
Pen–pack of 50s	17
Marker–pack of 12	20
Note books (inventory book)	37
Masking tape	36
Torch lights	18
Batteries–pairs	70
Scissors	35
Chalks–packs of 100	600
Lubricating oil–1L	17
Filter cloth (A4 size)	275
Rubber bands–packs	36
Polythene sheet–3 meter	50
Nylon rope 60 meter	3
Activated charcoal tablets–packs of 50	20
Insectary refrigerator	1

Item Description	Qty
Basin–40 L	5
First aid boxes–fully kitted	34
Overalls	68
Calculators	90
Forceps	10
Micro-slips	3
Normal saline–1L	2
Reusable nose mask (industrial)	34
Disposable nose mask N95 series-pack of 20s	195
Black liners (dozen)	8
Yellow liners (dozen)	20
Fire extinguishers CO_2	6
Metal shovel–long handle	2
Store/soak pit signage	4
Filter cartridges (for industrial nose mask)	290
Water pH meter (digital)	5
Water pH test paper (indicrom)-packs	5
Buffer solutions–1L	7
Distilled water–1L	10
Hydrocortisone cream–15g tubes	320
Pregnancy test kit–pack of 50s	4
Paracetamol tablets 500mg–pack of 96	120
Insectary freezer	1

TABLE A-3: 2013 DISPATCHED COMMODITIES AND POST-SPRAY INVENTORY

S/No	Description of Items	Warehouse Pre-Dispatch Inventory	Doma Sites Dispatch	Nass. Eggon Sites Dispatch	Total Dispatch	Buffer	Central Warehouse Post-Spray Inventory
1	IRS cards	100000	35000	45000	80000	20000	13,561
2	Insecticides–sachets	40000	18440	21560	40000	0	4
3	X-pert sprayer	275	120	130	250	25	275
4	Spare-part kit (full kitting)	30	12	10	22	8	6
5	Helmet	339	155	167	322	17	339
6	Face shield	377	155	167	322	55	157
7	Faceshield bracket	355	155	167	322	33	355
8	Rubber gloves–pairs (long)–washers	38	20	14	34	4	38
9	Red hand gloves–hard type	338	143	169	312	26	307
10	Rubber gloves–pairs (short) –soft type	98	40	28	68	30	90
11	Gum boots–pairs	405	195	195	390	15	390
12	Apron	44	24	20	44	0	44
13	Socks–pairs	712	350	362	712	0	0
14	Overalls	755	350	362	712	43	749
15	Disposable mouth/nose mask N95 series-units	3900	1880	1920	3900	0	620
16	Mouth/nose mask–reusable	340	155	167	322	18	322
17	Haversack	317	153	164	317	0	315
18	Wooden pallets	50	24	21	45	5	50
19	Warning sign–store	17	10	7	17	0	17
20	Warning sign–soak pit	17	10	7	17	0	17
21	Fire extinguisher	34	20	14	34	0	38
22	First aid box	49	26	23	49	0	49
23	Shovel–long handle	17	10	7	17	0	17
24	Waste picker	52	26	23	49	2	52
25	Bucket plastic–15L	102	43	41	84	18	95
26	Padlock	34	20	14	34	0	0
27	Nylon rope–60metre	17	10	7	17	0	17
28	Liquid (washing) soap 20L	36	15	21	36	0	0
29	Basin–20 litres	34	20	14	34	0	34
30	Basin–40 litres	22	12	10	22	0	24
31	Barrel–100 litres	135	72	56	128	7	137
32	Barrel–200 litres	32	16	12	28	4	132
33	Jerry can 20 litres	34	20	14	34	0	33
34	Jug–2 Litres	81	30	21	51	30	75

S/No	Description of Items	Warehouse Pre-Dispatch Inventory	Doma Sites Dispatch	Nass. Eggon Sites Dispatch	Total Dispatch	Buffer	Central Warehouse Post-Spray Inventory
35	Polythene sheet 3 metres	260	120	130	250	10	235
36	Rubber bands–pack	36	20	14	34	2	0
37	Calculator	142	33	34	67	75	118
38	Chalk–box of 100	670	270	286	556	114	150
39	Hard cover book–long (Ledger)	20	10	7	17	3	0
40	Hard cover book–short (spray book)	17	10	7	17	0	0
41	Brush with hard thistle–long	52	24	20	44	8	49
42	Brush–short	50	24	20	44	6	43
43	Bucket–metal	34	20	14	34	0	34
44	Plier–adjustable	17	10	7	17	0	17
45	Screw driver	50	20	14	34	16	41
46	Scissors	275	120	130	250	25	260
47	Bathing soap–Lux Tablet	2070	1010	1060	2070	0	0
48	Towel	350	175	174	349	1	0
49	Filter cloth–A4 size	275	120	130	250	25	0
50	Lubricating oil–1 litre	17	10	7	17	0	0
51	Wall thermometer	18	10	7	17	1	18
52	Temperature chart	17	10	7	17	0	0
53	Black liner	142	72	60	132	10	0
54	Yellow liner	560	200	220	420	140	0
55	Pen/biro–red	100	48	52	100	0	0
56	Pen/biro–-blue	750	366	378	744	6	0
57	Whistle	34	20	14	34	0	23
58	Torchlight	18	10	7	17	1	8
59	Batteries–pairs	70	40	28	68	2	0
60	Marker pen	280	132	146	278	2	151
61	Masking tape	36	20	14	34	2	0
62	Hydrocortisone–cream–15g	340	155	161	316	14	0
63	Milk of magnesia-100ml	40	20	20	40	0	0
64	Activated charcoal tabs 50s	29	15	14	29	0	0
65	Paracetamol–96 tab-pack	120	52	68	120	0	0
66	Spare parts kit (some kits used)						44
67	Weighing balance						1
68	Digital pH metre						5

TABLE A-4. NUMBER OF SEASONAL WORKERS TRAINED TO SUPPORT IRS

Type of Personnel	No. of Males	No. of Females	Total
Key Personnel (MEP indicator 5.1.1)			
Spray operator	239	35	274
Team leaders	49	1	50
Supervisors	6	0	6
Health workers	31	18	49
IRS Coordinators	2	0	2
Other Seasonal Workers (MEP indicator 5.1.2)			
Mobilizers' coordinators	2	0	2
IEC mobilizers	98	23	121
Health workers	31	18	49
Pump technicians	16	1	17
Store keepers	12	5	17
Washers	6	16	22
Security	33	1	34
Drivers	44	0	44
Data assistant	1	1	2
Data entry clerk	8	5	13
Total	547	106	**653**
Percentage (%)	**83.8**	**16.2**	

TABLE A-5. NUMBER OF HIRED FIELD WORKERS

Type of Personnel	No. of Males	No. of Females	Total
Spray operator	220	30	250
Team leaders	49	1	50
Supervisors	6	0	6
IRS coordinators	2	0	2
Mobilizers' coordinator	2	0	2
IEC mobilizers	98	23	121
IEC supervisors	32	17	49
Pump technicians	16	1	17
Store keepers	12	5	17
Washers	6	16	22
Security	33	1	34
Drivers	44	0	44
Data assistant	1	1	2
Data entry clerk	5	5	10
Total	526	100	**626**
Percentage	**84.0**	**16.0**	**100.0**

Annex B. Mid-Spray Environmental Compliance Report

Summary

In line with environmental compliance procedures for AIRS, a mid-spray environmental compliance assessment was conducted by Abt technical staff in the company of trained FMEnv and NESREA representatives. The assessment highlighted the need for improved PPE usage compliance, end-of-day clean-up, spray operator performance, homeowner preparation, spray operator morning mobilization, and storage facilities and store keeper performance at every operational center in Doma and Nasarawa Eggon LGAs.

The storage facilities were in good condition and well managed by trained store keepers, and spray operators followed Best Management Practices Manual (BMP) during spraying and wash-up activities. Most of the problems or risks observed were minor and easily corrected.

The soak pits were constructed appropriately, which is very important for the treatment of all effluent waste from the IRS activities. The soak pits have the recommended filter system installed and were designed to accommodate a specific number of spray operators at a time during the rinsing and washing activities.

A common problem in many PMI countries is identifying solutions for solid waste disposal. The IRS program in Nigeria has access to the NIPRD incinerator, which meets the requirements in the BMP for incinerating IRS wastes including expired pesticides.

Assessment of IRS activities

The assessment was carried out by monitoring teams that comprised Abt field staff, representatives from the NMCP, SMOH, NESREA, FMEnv, and Doma and Nasarawa Eggon LGAs. This was done with the aid of mid-spray monitoring checklists to evaluate the following areas:

- Workers health and safety;
- Storage and stock control;
- Transportation;
- Spraying techniques;
- Wash activities; and
- Waste disposal (effluent and solid).

Findings

Storage and stock control at both the central warehouse and community stores

To comply with the rules and regulations of the United Nations Food and Agriculture Organization regarding the storage of hazardous material, the community stores were renovated and partitioned to

accommodate different activities, and additional doors were installed to enhance ventilation. Ceiling fans were also installed in the central warehouse in Lafia.

IRS Nigeria stored insecticides, materials, and equipment at this central warehouse before distributing them to the community stores. The warehouse is in good condition and meets BMP requirements for structures. It was managed very well with a thorough accountability system. The community storage facilities were in good condition and the store keepers did a good job at managing the stock and keeping everything organized. Each store keeper worked closely with the spray team leaders during daily start-up activities and end-of-day activities to account for used and unused materials, ensuring that the facilities run smoothly. All store keepers wore appropriate PPE.

All facilities were well signed with skull and crossbones and had double locks, 24-hour guards, kitted first aid boxes, and fire extinguishers in both inside and outside buckets of sand with shovels for spill response.

There was good accountability and record keeping of pesticide sachets at the community stores, from dispersal to collection at the end of the day. Each store keeper counted out and documented the required number of sachets to be distributed to the spray team leaders, who in turn counted out and documented the sachets allocated to each spray operator. At the end of the day, the process was repeated and the used and unused sachets collected and recorded.

Transportation

IRS Nigeria deployed about 32 buses to carry spray teams and 12 J5 trucks to distribute the materials and equipment from the central store to the community stores. Bicycles were also used, to access the mountainous and hard-to-reach areas as each spray operator could easily ride directly to each house that usually is only accessible on foot. Most of the spray operators are from the same community/ward as the respective spray operations, so distances and time were minimal. When riding in the trucks, the spray operator put the spray pump securely on their laps and there appeared to be no spillage or compliance issues with such transportation. All the drivers were trained and had the needed certifications for transporting hazardous goods and numerous people. The vehicles were provided with a kitted first aid box, a spill kit, and a sheet with instructions for emergency/accident response procedures; no vehicular accident was reported.

Spray operations and techniques

Overall the spray operators wore their full and appropriate PPE (including neck protectors to ensure no skin was exposed) and knew the proper spray techniques. None of them had any problem with skin irritation.

Since the spray operators were from the ward, they had good relationships with the beneficiaries. Before beginning operations, they discussed the spray activities with each resident, informing them of health and safety measures. Before spraying, they showed the resident the contents of the spray pump, to assure them that they were using pesticides (and not just water – it is also another means to regulate pilferage). The sprayer was shaken to mix the contents and pressurized to 55 psi before spraying.

The operator sprayed only the recommended surfaces: inside walls, back of doors, eaves, and ceilings. A few of the spray nozzles leaked and these were fixed immediately by the trained technicians. There was no observation of eating, smoking, or drinking during spray hours.

Afterward, the spray operator completed the tracking form and had the resident sign it to ensure the information was correct. These forms were collected by the team leader at the end of the day.

Clean-up facilities and wash-up activities

All clean-up facilities/soak pits are located adjacent to the community storage facilities. Good signage is located on the gates to all wash-up facilities. The soak pits have wire gauze fencing and entrance door, and are well laid out for ease of access to progressive rinse and follow-up washing in the soak pit.

All progressive rinse barrels were ready for wash activities before the spray operators arrived. At several locations there was enough water in the even-numbered barrels. All people in the wash/soak pit area wore full PPE. When the spray operators returned from the field, they emptied their pumps into a #1 drum and then started the progressive rinse of their sprayers.

The spray operators implemented the appropriate wash-up practices, and efficiently cleaned off their spray pumps, boots, gloves, visors, and tarpaulin in the soak pit after the progressive rinse. All washed overalls were hung over the soak pits to dry. All contaminated water was drained into the soak pit area without creating a puddle or run-off. Two sets of PPE are available for each spray operator, and the PPE that was worn that day was washed at the end of the day.

All the barrels including the one containing the leftover pesticide from the day's spray operations were securely covered at the end of each day.

Washing and drying PPE in the soak pit

Performing the progressive, triple-rinse clean-up procedure

Solid waste disposal

Solid wastes were segregated into general and hazardous waste and stored in the appropriate bin liners in all the community stores visited. The empty sachets were stored in yellow bin liners and kept on pallets, separate from other materials in the stores. The used nose masks and respirator filters were also stored in separate containers. There is an agreement with NIPRD to incinerate the waste at the end of spray operations.

General Observations:

- • Good collaboration with SMOH, local governments, and supporting partners
- • Good IEC and interaction with the beneficiaries
- • Good storage facilities and management of stock
- • Good management of spray personnel
- • Good accountability of pesticide from distribution to collection at end of the day
- • Spray operators followed BMP (spraying techniques and PPE) and record-keeping practices
- • Overall good wash-up practices
- • Good waste management
- • Good warning signage at all facilities

ANNEX C. POST-SPRAY INSPECTION REPORTS

IRS Environmental Inspection Report Form
Post-Spray Inspection
Date of Inspection : 18/06/2013
Country: Nigeria
County:
District Doma
Village: Agbashi
GPS coordinates : 08° 00'.376"N 008° 18'.778"E
Inspectors : Mr. Gbolagade F. & NESREA Rep.

CDC USAID FROM THE AMERICAN PEOPLE
President's Malaria Initiative

BMP Requirement	Y	N	Comments/Recommended Actions	Completion Date if Applicable
1) Are all the IRS items, insecticides and wastes taken back to the district store?	✓			
2) Does the addition of used insecticides and unused insecticides equal total number of insecticides given?	✓			
3) Is the store cleaned before being handed over to the owners?	✓			
4) Is the soak pit left with gates closed?	✓			
5) Are the soak pit and its surroundings left clean?	✓			
6) Was the working relationship between the IRS team and owners of the store good?	✓			

Additional Comments
There is growing vegetation in ~~the~~ soak pit surroundings, showing that the environment is not in any way contaminated.

STATE COORDINATOR
NATIONAL ENVIRONMENTAL STANDARDS & REGULATIONS ENFORCEMENT AGENCY LAGOS
SIGN
DATE 24-06-13

IRS Environmental Inspection Report Form
Post-Spray Inspection
Date of Inspection : 18/06/2013
Country: Nigeria
District Doma
County:
Village: Agrima
GPS coordinates : 07°52'33.1"N 008°25'29"E
Inspectors : Engr. Gbolagade F. & NESREA Rep.

CDC USAID FROM THE AMERICAN PEOPLE President's Malaria Initiative

BMP Requirement	Y	N	Comments/Recommended Actions	Completion Date if Applicable
1) Are all the IRS items, insecticides and wastes taken back to the district store?	✓			
2) Does the addition of used insecticides and unused insecticides equal total number of insecticides given?	✓			
3) Is the store cleaned before being handed over to the owners?	✓			
4) Is the soak pit left with gates closed?	✓			
5) Are the soak pit and its surroundings left clean?	✓			
6) Was the working relationship between the IRS team and owners of the store good?	✓			

Additional Comments
Sign of green vegetation around the soak pit as evidence of non-contamination of soil.

STATE COORDINATOR NATIONAL ENVIRONMENTAL STANDARDS & REGULATIONS ENFORCEMENT AGENCY LAFIA
SIGN
DATE 24-06-13

IRS Environmental Inspection Report Form
Post-Spray Inspection
Date of Inspection : 18 / 06 / 2013
Country: Nigeria
District Dome
County:
Village: RUKUBI
GPS coordinates : 07° 52' 937" N 005° 18' 304" E
Inspectors : Mr. Gbulgade F. & NESREA Rep.

CDC USAID FROM THE AMERICAN PEOPLE
President's Malaria Initiative

BMP Requirement	Y	N	Comments/Recommended Actions	Completion Date if Applicable
1) Are all the IRS items, insecticides and wastes taken back to the district store?	✓			
2) Does the addition of used insecticides and unused insecticides equal total number of insecticides given?	✓			
3) Is the store cleaned before being handed over to the owners?	✓			
4) Is the soak pit left with gates closed?	✓			
5) Are the soak pit and its surroundings left clean?	✓			
6) Was the working relationship between the IRS team and owners of the store good?	✓			

Additional Comments: Growing vegetation around the soak pit shows that the environment is not contam

STATE COORDINATOR NATIONAL ENVIRONMENTAL STANDARDS & REGULATIONS ENFORCEMENT AGENCY LAFIA
SIGN
DATE 24-06-13

IRS Environmental Inspection Report Form
Post-Spray Inspection
Date of Inspection : 18 / 06 / 2013
Country: Nigeria
County:
GPS coordinates : 07° 48'. 048" N 008° 24' 855" E
Inspectors : Mr- Gbolagade F. & NESREA Rep.

District Doma
Village: Akpanga

President's Malaria Initiative

BMP Requirement	Y	N	Comments/Recommended Actions	Completion Date if Applicable
1) Are all the IRS items, insecticides and wastes taken back to the district store?	✓			
2) Does the addition of used insecticides and unused insecticides equal total number of insecticides given?	✓			
3) Is the store cleaned before being handed over to the owners?	✓			
4) Is the soak pit left with gates closed?	✓			
5) Are the soak pit and its surroundings left clean?	✓			
6) Was the working relationship between the IRS team and owners of the store good?	✓			

Additional Comments
Springing vegetation and ~~ant~~ ant hill around the soak pit is an evidence of non contamination

STATE COORDINATOR
NATIONAL ENVIRONMENTAL STANDARDS & REGULATIONS ENFORCEMENT AGENCY LAFIA
SIGN
DATE 24-06-13

IRS Environmental Inspection Report Form
Post-Spray Inspection
Date of Inspection : 17 / 06 / 2013
Country:
County: NIGERIA
District Doma
Village: Doma
GPS coordinates : 08° 24'. 861"N 008° 21.971" E
Inspectors GBolagade F. NESREA REP

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President's Malaria Initiative

BMP Requirement	Y	N	Comments/Recommended Actions	Completion Date if Applicable
1) Are all the IRS items, insecticides and wastes taken back to the district store?	✓			
2) Does the addition of used insecticides and unused insecticides equal total number of insecticides given?	✓			
3) Is the store cleaned before being handed over to the owners?	✓			
4) Is the soak pit left with gates closed?	✓			
5) Are the soak pit and its surroundings left clean?	✓			
6) Was the working relationship between the IRS team and owners of the store good?	✓			

Additional Comments
There is sign of grown grasses around the soak pit, is an evidence of non-contamination of the soil.

STATE COORDINATOR
NATIONAL ENVIRONMENTAL STANDARDS & REGULATIONS ENFORCEMENT AGENCY LAGOS
SIGN
DATE 24-06-13

IRS Environmental Inspection Report Form
Post-Spray Inspection
Date of Inspection: 17/06/2013
Country: Nigeria
County:
GPS coordinates: 08° 05' 8.40"N 008° 21' 16.8"E
Inspectors: Gbalagada F. and NESREA Representative

District: Doma
Village: Sarkin Dawaki

President's Malaria Initiative

BMP Requirement	Y	N	Comments/Recommended Actions	Completion Date if Applicable
1) Are all the IRS items, insecticides and wastes taken back to the district store?	✓			
2) Does the addition of used insecticides and unused insecticides equal total number of insecticides given?	✓			
3) Is the store cleaned before being handed over to the owners?	✓			
4) Is the soak pit left with gates closed?	✓			
5) Are the soak pit and its surroundings left clean?	✓			
6) Was the working relationship between the IRS team and owners of the store good?	✓			

Additional Comments
There is growing vegetation soak pit surrounding a sign that the environment is not badly contaminated.

STATE COORDINATOR
NATIONAL ENVIRONMENTAL STANDARDS & REGULATIONS ENFORCEMENT AGENCY LAFIA
SIGN
DATE 24-06-13

IRS Environmental Inspection Report Form
Post-Spray Inspection
Date of Inspection : 17/06/2013
Country: Nigeria
County:
District Doma
Village: Idadu
GPS coordinates : 08°09' 157"N 008°16' 075" E
Inspectors : ~~[illegible]~~ G Balagade F. & NESREA REP.

President's Malaria Initiative

BMP Requirement	Y	N	Comments/Recommended Actions	Completion Date if Applicable
1) Are all the IRS items, insecticides and wastes taken back to the district store?	✓			
2) Does the addition of used insecticides and unused insecticides equal total number of insecticides given?	✓			
3) Is the store cleaned before being handed over to the owners?	✓			
4) Is the soak pit left with gates closed?	✓			
5) Are the soak pit and its surroundings left clean?	✓			
6) Was the working relationship between the IRS team and owners of the store good?	✓			

Additional Comments
Vegetation are springing up around the soak pit, is an evidence of non-contamination.

STATE COORDINATOR
NATIONAL ENVIRONMENTAL STANDARDS & REGULATIONS ENFORCEMENT AGENCY LAFIA
SIGN
DATE 24-06-13

IRS Environmental Inspection Report Form
Post-Spray Inspection
Date of Inspection : 17 / 06 / 2013
Country: Nigeria
District Doma
County:
Village: Yelwa
GPS coordinates : 08°16'904"N 008°18'.778"E
Inspectors : Mr - Gibolagade F. and NESREA REP

CDC USAID FROM THE AMERICAN PEOPLE
President's Malaria Initiative

BMP Requirement	Y	N	Comments/Recommended Actions	Completion Date if Applicable
1) Are all the IRS items, insecticides and wastes taken back to the district store?	✓			
2) Does the addition of used insecticides and unused insecticides equal total number of insecticides given?	✓			
3) Is the store cleaned before being handed over to the owners?	✓			
4) Is the soak pit left with gates closed?	✓			
5) Are the soak pit and its surroundings left clean?	✓			
6) Was the working relationship between the IRS team and owners of the store good?	✓			

Additional Comments
Sign of grown vegetation around the soak pit is an evidence that the environment were not contaminated.

STATE COORDINATOR
NATIONAL ENVIRONMENTAL STANDARDS & REGULATIONS ENFORCEMENT AGENCY LAFIA
SIGN
DATE 24-06-13

IRS Environmental Inspection Report Form
Post-Spray Inspection
Date of Inspection : 17/06/2013
Country: Nigeria
County:
District Doma
Village: Alagye
GPS coordinates : 08°21'284"N 008°15'41.6"E
Inspectors : Mr. Gbolagade F. and NESREA Rep.

President's Malaria Initiative

BMP Requirement	Y	N	Comments/Recommended Actions	Completion Date if Applicable
1) Are all the IRS items, insecticides and wastes taken back to the district store?	✓			
2) Does the addition of used insecticides and unused insecticides equal total number of insecticides given?	✓			
3) Is the store cleaned before being handed over to the owners?	✓			
4) Is the soak pit left with gates closed?	✓			
5) Are the soak pit and its surroundings left clean?	✓			
6) Was the working relationship between the IRS team and owners of the store good?	✓			

Additional Comments
There is springing vegetation in the sorroundings of the soak pit, which shows that the environment is not contaminated

STATE COORDINATOR NATIONAL ENVIRONMENTAL STANDARDS & REGULATIONS ENFORCEMENT AGENCY LAGOS
24-06-13

IRS Environmental Inspection Report Form
Post-Spray Inspection
Date of Inspection : 14 / 06 / 2013
Country: Nigeria
District N/Eggon
County:
Village: N/Eggon
GPS coordinates : 08°42'249"N 008°32'272"
Inspectors : Mr. Gbolagade F. & NZSREA Rep.

President's Malaria Initiative

BMP Requirement	Y	N	Comments/Recommended Actions	Completion Date if Applicable
1) Are all the IRS items, insecticides and wastes taken back to the district store?	✓			
2) Does the addition of used insecticides and unused insecticides equal total number of insecticides given?	✓			
3) Is the store cleaned before being handed over to the owners?	✓			
4) Is the soak pit left with gates closed?	✓			
5) Are the soak pit and its surroundings left clean?	✓			
6) Was the working relationship between the IRS team and owners of the store good?	✓			

Additional Comments
There is sign of growing vegetation around the soak pit, which is an evidence of non-contamination.

STATE COORDINATOR NATIONAL ENVIRONMENTAL STANDARDS & REGULATIONS ENFORCEMENT AGENCY LAPA
SIGN
DATE 14-06-13

IRS Environmental Inspection Report Form
Post-Spray Inspection
Date of Inspection : 14 / 08 / 2013
Country: Nigeria
County:
District N/Eggon
Village: Mada station
GPS coordinates : 08° 40' 713"N 008° 18' 581"E
Inspectors : Mr- Gbotagade F. & NESREA Rep.

CDC USAID FROM THE AMERICAN PEOPLE President's Malaria Initiative

BMP Requirement	Y	N	Comments/Recommended Actions	Completion Date if Applicable
1) Are all the IRS items, insecticides and wastes taken back to the district store?	✓			
2) Does the addition of used insecticides and unused insecticides equal total number of insecticides given?	✓			
3) Is the store cleaned before being handed over to the owners?	✓			
4) Is the soak pit left with gates closed?	✓			
5) Are the soak pit and its surroundings left clean?	✓			
6) Was the working relationship between the IRS team and owners of the store good?	✓			

Additional Comments
Growing vegetations and an rodent hole besides the soak pit an evidence of non-contamination of the soil.

STATE COORDINATOR NATIONAL ENVIRONMENTAL STANDARDS & REGULATIONS ENFORCEMENT AGENCY LAFIA
SIGN
DATE 24-8-13

IRS Environmental Inspection Report Form
Post-Spray Inspection
Date of Inspection : 14/06/2013
Country: Nigeria
County:
District N/Eggon
Village: Lambage
GPS coordinates : 08° 40' 323" N 008° 24' 476" E
Inspectors : Mr. Gbolagade F. & NESREA Rep

CDC USAID FROM THE AMERICAN PEOPLE
President's Malaria Initiative

BMP Requirement	Y	N	Comments/Recommended Actions	Completion Date If Applicable
1) Are all the IRS items, insecticides and wastes taken back to the district store?	✓			
2) Does the addition of used insecticides and unused insecticides equal total number of insecticides given?	✓			
3) Is the store cleaned before being handed over to the owners?	✓			
4) Is the soak pit left with gates closed?	✓			
5) Are the soak pit and its surroundings left clean?	✓			
6) Was the working relationship between the IRS team and owners of the store good?	✓			

Additional Comments
Springing vegetation around the soak pit is an evidence of non-contamination of the environment.

STATE COORDINATOR NATIONAL ENVIRONMENTAL STANDARDS & REGULATIONS ENFORCEMENT AGENCY
24-06-13

IRS Environmental Inspection Report Form
Post-Spray Inspection
Date of Inspection : 14 / 06 / 2013
Country: Nigeria
County:
District N/Eggon
Village: Bakyano
GPS coordinates : 08° 45'857"N 008° 37'592"E
Inspectors : Mr. Gbagede F. & NESREA Rep.

President's Malaria Initiative

BMP Requirement	Y	N	Comments/Recommended Actions	Completion Date if Applicable
1) Are all the IRS items, insecticides and wastes taken back to the district store?	✓			
2) Does the addition of used insecticides and unused insecticides equal total number of insecticides given?	✓			
3) Is the store cleaned before being handed over to the owners?	✓			
4) Is the soak pit left with gates closed?	✓			
5) Are the soak pit and its surroundings left clean?	✓			
6) Was the working relationship between the IRS team and owners of the store good?	✓			

Additional Comments
Sign of grown vegetation around the soak pit as evidence of non-contamination.

STATE COORDINATOR
NATIONAL ENVIRONMENTAL STANDARDS & REGULATIONS ENFORCEMENT AGENCY LAFIA
SIGN
DATE 24-06-13

IRS Environmental Inspection Report Form
Post-Spray Inspection
Date of Inspection : 15 / 06 / 2013
Country: Nigeria
County:
District N/Eggon
Village: IWUKO
GPS coordinates : 08°51'181"N 008°27'592"E
Inspectors : Mr. Gbolagade F. and NESREA Rep.

CDC USAID FROM THE AMERICAN PEOPLE
President's Malaria Initiative

BMP Requirement	Y	N	Comments/Recommended Actions	Completion Date if Applicable
1) Are all the IRS items, insecticides and wastes taken back to the district store?	✓			
2) Does the addition of used insecticides and unused insecticides equal total number of insecticides given?	✓			
3) Is the store cleaned before being handed over to the owners?	✓			
4) Is the soak pit left with gates closed?	✓			
5) Are the soak pit and its surroundings left clean?	✓			
6) Was the working relationship between the IRS team and owners of the store good?	✓			

Additional Comments
Growing vegetation around the soak pit, these shows that the environment is not contaminated

STATE COORDINATOR NATIONAL ENVIRONMENTAL STANDARDS REGULATIONS ENFORCEMENT AGENCY LAFIA
24-06-13

IRS Environmental Inspection Report Form
Post-Spray Inspection
Date of Inspection : 15 / 06 / 2013
Country: Nigeria
County:
GPS coordinates : 08° 34'. 318" N 008° 19' 254" E
Inspectors : Mr. Gbolagade F. and NESREA Rep

District Niger
Village: Bunum Burum

CDC USAID FROM THE AMERICAN PEOPLE
President's Malaria Initiative

BMP Requirement	Y	N	Comments/Recommended Actions	Completion Date if Applicable
1) Are all the IRS items, insecticides and wastes taken back to the district store?	✓			
2) Does the addition of used insecticides and unused insecticides equal total number of insecticides given?	✓			
3) Is the store cleaned before being handed over to the owners?	✓			
4) Is the soak pit left with gates closed?	✓			
5) Are the soak pit and its surroundings left clean?	✓			
6) Was the working relationship between the IRS team and owners of the store good?	✓			

Additional Comments
There is springing vegetation around the Soak-pit is an evidence of non contamination of the environment.

STATE COORDINATOR
NATIONAL ENVIRONMENTAL STANDARDS & REGULATIONS ENFORCEMENT AGENCY LAFIA
SIGN
DATE 24-06-13

IRS Environmental Inspection Report Form
Post-Spray Inspection
Date of Inspection : 15 / 06 / 2013
Country: Nigeria
County:
District N/Eggon
Village: Alushi
GPS coordinates : 08° 55' 033"N 008° 22' 147"E
Inspectors : Mr. Gbolagade F. & NESREA Rep.

BMP Requirement	Y	N	Comments/Recommended Actions	Completion Date if Applicable
1) Are all the IRS items, insecticides and wastes taken back to the district store?	✓			
2) Does the addition of used insecticides and unused insecticides equal total number of insecticides given?	✓			
3) Is the store cleaned before being handed over to the owners?	✓			
4) Is the soak pit left with gates closed?	✓			
5) Are the soak pit and its surroundings left clean?	✓			
6) Was the working relationship between the IRS team and owners of the store good?	✓			

Additional Comments
There is growing vegetation within the surroundings of the soak. pit, this shows that the soil is contaminated.

STATE COORDINATOR NATIONAL ENVIRONMENTAL STANDARDS & REGULATIONS ENFORCEMENT AGENCY LAFIA
24-06-13

ANNEX D. INCINERATION CERTIFICATE

NATIONAL INSTITUTE FOR PHARMACEUTICAL RESEARCH & DEVELOPMENT (NIPRD)
FEDERAL MINISTRY OF HEALTH

Office of the Director General / Chief Executive

10th July, 2013

The Chief of Party,
African Indoor Residual Spraying (AIRS), Nigeria/USAID Project
Shendam Road Lafia,
Nasarawa State

Sir,

CERTIFICATE OF DISPOSAL

This is to certify that **168.9Kg** of waste made up of empty **insecticide sachets, used disposable nose masks and used respirator canisters** was incinerated for Abt Associates Inc. (Abt Development Foundation) via High Temperature Incineration at National Institute for Pharmaceutical Research and Development (NIPRD), Idu Industrial Layout Abuja. The bottom ash generated from the incineration process was also encapsulated to meet Environmental Regulatory Authority Standards.

Thank you

For **NIPRD**

Moji Gimari
Head, NIPRD Consult

NIPRD INCINERATOR SPECIFICATION (It was constructed by BOSKEL)

BOSKEL NIGERIA LIMITED
HIGHMAL PROCESS ENGINEERING
ENVIRONMENTAL MANAGEMENT

BOSKEL'S INCINERATORS FOR WASTES

TECHNICAL SPECIFICATIONS

- **TYPE:**
  - Rotary Kiln
- **CAPACITY:**
  - 5 - 60 T/day Hospital/Hazardous wastes (Normal operations)
- **SPEED OF ROTATION:**
  - 0.5 – 2 rpm
- **INCLINATION:** 2 - 3° to the horizontal
- **REFRACTORIES:**
  - High Alumina Ramming Mass of Service Temperature 1750°C
- **BURNERS:**
  - Dual fuel (Natural Gas, Diesel/Waste oil)
- **AFTER BURNER CHAMBER:**
  - STATIONARY, HORIZONTAL
- **OPERATING TEMPERATURES:**
  - KILN = 500°C – 1100°C
  - AFTER BURNER = 1200°C
- **OPERATING PRESSURE:**
  - SLIGHTLY BELOW ATMOSPHERIC
- **RESIDENCE TIMES IN SYSTEM:**
  - **ROTARY KILN (Wastes)**: 30 - 45 minutes
  - **AFTERBURNER CHAMBER (Flue Gases)**: 2 seconds maximum
- **FLUE GAS TREATMENT (WET SCRUBBING):**
  - **QUENCH – VENTURI**: Quenching with water
  - **PACKED SCRUBBER** (with alkaline water)

ANNEX E. OUTPUT/PROCESS INDICATORS

TABLE D-1: AIRS NIGERIA MONITORING AND EVALUATION PLAN INDICATOR MATRIX

Performance Indicator	Indicator Definition	Project Year(s) Reporting	Data Source(s) and Reporting Frequency	Disaggregate	PMI/ AIRS Indicator	Annual Targets and Results			
						Year 1		Year 2	
						Target	Result	Target	Result
Component 1: Establish cost-effective supply chain mechanisms including procurement, distribution and storage of IRS-related commodities and execute all aspects of logistical plans for IRS-related activities.									
1.1 Procurement									
1.1.1 Number and percentage of international insecticide procurement orders delivered in country, at port of entry, at least 30 days prior to the start of spray operations	[*Numerator:* Number of international insecticide procurement orders delivered in country, at port of entry, at least 30 days prior to the start of spray operations] [*Denominator:* Total number of international insecticide procurement orders] *Calculation:* [Numerator ÷ Denominator] x 100	Y1, Y2, Y3	*Data source*: Project records – Air Ways Bill (AWB), Commercial Invoices *Reporting frequency*: Each spray season	By Spray Campaign	AIRS	N.A.; 80%	1; 50%	1; 100%	1; 100%
1.1.2 Number and percentage of international pocurement orders for equipment, including PPE, received at port of entry, 30 days prior to start of spray operations.	[*Numerator:* Number of international procurements for equipment, including PPE, received at port of entry, 30 days prior to start of spray operations] [*Denominator*: Total number of international procurements for equipment, including PPE.] *Calculation:* [Numerator ÷ Denominator] x 100	Y1, Y2, Y3	*Data source:* Logistics and Procurement Inventory Reports *Reporting frequency*: Each spray season	By Spray Campaign	AIRS	N.A.; 85%	1; 50%	3; 100%	3; 100%

Performance Indicator	Indicator Definition	Project Year(s) Reporting	Data Source(s) and Reporting Frequency	Disaggregate	PMI/ AIRS Indicator	Annual Targets and Results			
						Year 1		Year 2	
						Target	Result	Target	Result
1.1.3 Number and percentage of local PPE procurement orders that are delivered to the main warehouse, 14 days before the start of spray operations	[*[Numerator:* Number of local PPE procurement orders delivered to the main warehouse, 14 days before the start of spray operations] [*Denominator*: Total number of local PPE procurement orders.] *Calculation:* [Numerator ÷ Denominator] x 100	Y1, Y2, Y3	*Data source: Project records – delivery notes, goods receiving notes, inventory control card* *Reporting frequency*: Each spray season	By Spray Campaign	AIRS	N.A.; 80%	N.A.	6; 100%	6; 100%
1.1.4 Successfully completed spray operations without an insecticide stock-out	Milestone: (Achived/Not achieved)	Y1, Y2, Y3	*Data source:* Logistics Inventory Report *Reporting frequency*: Each spray season	By Spray Campaign	AIRS	Achieved	Not Achieved	Achieved	Achieved
1.2 In-country Logistics, Warehousing, and Training									
1.2.1 Number and percentage of logistics and warehouse managers trained in IRS supply chain management	*[Numerator:* Total number of logistics and warehouse managers trained in IRS supply chain management using AIRS Project resources.] *[Denominator:* Total number of AIRS logistics and warehouse managers.] *Calculation*: [Numerator ÷ Denominator] x 100	Y1, Y2, Y3	*Data source*: Routine training records *Reporting frequency*: Each spray season	By Spray Campaign By Gender	AIRS	N.A.	16; 100% 4 females, 12 males	17; 100% 5 females, 12 males	17; 100% 5 females, 12 males

Performance Indicator	Indicator Definition	Project Year(s) Reporting	Data Source(s) and Reporting Frequency	Disaggregate	PMI/ AIRS Indicator	Annual Targets and Results			
						Year 1		Year 2	
						Target	Result	Target	Result
1.2.2 Number and percentage of base stores where physical inventories are verified with up-to-date stock records	*[Numerator:* Number of base stores where physical inventories are verified by up-to-date stock records] [*Denominator*: Total number of base stores audited.] *Calculation:* [Numerator ÷ Denominator] x 100 *(See PIRS for details on sample size for operational audits)*	Y2, Y3	*Data source:* Logistics and Environmental compliance reports *Reporting frequency*: Each spray season	By Spray Campaign	AIRS	N.A.	N.A.	17; 100%	17; 100%
1.2.3 Submit up-to-date inventory records to AIRS Home Office 30 days after the end of each spray campaign	Milestone: (Completed/Not Completed)	Y2, Y3	*Data source: Post-Spray* Logistics Inventory Report *Reporting frequency*: Each spray season	By Spray Campaign	AIRS	N.A.	N.A.	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 IRS country work plan developed and submitted on time	Milestone: (Completed/Not Completed)	Y1, Y2, Y3	*Data source:* Project records *Reporting frequency*: Annually		AIRS	Completed	Completed	Completed	Completed
2.2 Support of Safety and Health Best Practices and Compliance with USAID and Host Country Environmental Regulations									
2.2.1 SEA/letter report submitted on time[1]	Milestone: (Completed/Not Completed)	Y1, Y2, Y3	*Data source*: Project records – submitted	By Spray Campaign	AIRS	Completed	Completed	Completed	Completed

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

Performance Indicator	Indicator Definition	Project Year(s) Reporting	Data Source(s) and Reporting Frequency	Disaggregate	PMI/ AIRS Indicator	Annual Targets and Results			
						Year 1		Year 2	
						Target	Result	Target	Result
			SEAs/ letter reports Reporting frequency: Each spray campaign						
2.2.2 Number and percentage of soak pits and storehouses inspected and approved prior to spraying	[Numerator: Number and percentage of soak pits and warehouses/storerooms inspected and certified by an environmental officer/AIRS Environmental Compliance Officer prior to each spray campaign supported by the AIRS Project] [Denominator: Total number of project soak pits and/or storehouses] Calculation: *[Numerator ÷ Denominator] x 100*	Y1, Y2, Y3	Data source: Pre, Mid and Post Inspection Reports submitted by environmental officers Reporting frequency: Each spray season	By Spray Campaign By soak pits By warehouse/ storeroom	AIRS	30; 100% 15 soak pits, 15 ware-houses	28; 94% 15 soak pits, 13 ware-houses	34; 100% 17 soak pits, 17 ware-houses	30; 88.2% 15 soak pits, 15 ware-houses
2.2.3 Number of government environmental and health officers trained in IRS environmental compliance	Total number of government environmental and health officers trained in IRS environmental compliance using AIRS Project resources	Y1, Y2, Y3	*Data source:* Training reports from Environmental Compliance Officer Reporting frequency: Semi-annually	By Spray Campaign By Gender	AIRS	N.A.	7; 7 males	16; 1 female, 15 males	16; 6 females, 10 males
2.2.4 Number of spray personnel trained in environmental compliance and personal safety standards in IRS implementation	Total number of spray personnel who attend a training in environmental compliance and personal safety standards in IRS implementation using AIRS Project resources, includes all staff who received environmental compliance training - spray operators, team leaders, washpersons, storekeepers, etc.	Y1, Y2, Y3	Data source: Project records – Training reports Reporting frequency: Each spray season	By Spray Campaign By Gender	AIRS	N.A.	520; 87 females, 433 males	530; 106 females, 424 males	653, 106 females 547 males
2.2.5 Number of health workers receiving insecticide poisoning case management training	Total number of clinical personnel trained in insecticide poisoning case management using AIRS Project resources	Y2, Y3	Data source: Project records – Training reports Reporting frequency:	By Spray Campaign By Gender	AIRS	N.A.	26; 12 females, 14 males	50; 25 females, 25 males	49, 31 females 18 males

Performance Indicator	Indicator Definition	Project Year(s) Reporting	Data Source(s) and Reporting Frequency	Disaggregate	PMI/ AIRS Indicator	Annual Targets and Results			
						Year 1		Year 2	
						Target	Result	Target	Result
			Each spray season						
2.2.6 Number of adverse reactions to pesticide exposure documented	Total number of incidents of pesticide exposure reported that resulted in a referral for medical care	Y1, Y2, Y3	Data source: Incident report forms that are required for each incidence of pesticide exposure Reporting frequency: Each spray season	By Spray Campaign By residential/occupational exposure	AIRS	0	0	0	0
2.2.7. Number of vehicular accidents reported	Total number of vehicular accidents reported	Y1, Y2, Y3	Data source: Vehicular incident report forms that are required for each accident Reporting frequency: Each spray season	By Spray Campaign	AIRS	0	0	0	0
2.3 Support Entomological Monitoring Activities and Insecticide Resistance Strategies									
2.3.1 Number of sentinel sites supported by the AIRS project	Total number of entomological sentinel sites supported by the AIRS project	Y1, Y2, Y3	Data source: Entomological reports Reporting frequency: Annually	By Spray Campaign	AIRS	4	3	3	3
2.3.2 Number and percentage of entomological monitoring sentinel sites measuring all five primary PMI entomological indicators	*[Numerator:* Number of entomological monitoring sites measuring all five primary PMI entomological indicators] *[Denominator:* Number of entomological monitoring sentinel sites] *Calculation:* [Numerator ÷ Denominator] x 100	Y1, Y2, Y3	Data source: Entomological reports *Reporting frequency:* Annually	By Spray Campaign	AIRS	2; 100%	2; 100%	2; 100%	2; 100%
2.3.3 Number and percentage of entomological moniotring sites	*[Numerator:* Number of entomological monitoring sites measuring at least one secondary PMI indicator]	Y1, Y2, Y3	Data source: Entomological reports Reporting frequency:	By Spray Campaign	AIRS	N.A.	N.A.	3; 100%	3; 100%

Performance Indicator	Indicator Definition	Project Year(s) Reporting	Data Source(s) and Reporting Frequency	Disaggregate	PMI/ AIRS Indicator	Annual Targets and Results			
						Year 1		Year 2	
						Target	Result	Target	Result
measuring at least one secondary PMI indicator	*[Denominator:* Number of entomological monitoring sites] *Calculation:* [Numerator ÷ Denominator] x 100		Annually						
2.3.4 Number and percentage of insecticide resistance testing sites that tested at least one insecticide from each of the four classes of insecticides recommended for malaria vector control	*[Numerator:* Number of insecticide resistance testing sites that tested at least one insecticide from each of the four classes of insecticides recommended for malaria vector control.] *[Denominator:* Number of insecticide resistance testing sites] *Calculation:* [Numerator ÷ Denominator] x 100	Y1, Y2, Y3	Data source: Entomological reports Reporting frequency: Annually	By Spray Campaign By Type of Insecticide	AIRS	4; 100%	2[2]; 50%	3[3]; 100%	Scheduled for September 2013
2.3.5 Number of wall bioassays conducted within 2 weeks of spraying to evaluate the quality of IRS	Total number of wall bioassay studies conducted in established sentinel sites to evaluate quality of IRS spraying activities	Y1, Y2, Y3	Data source: Entomological reports Reporting frequency: Per spray campaign	By Spray Campaign	PMI	10	23	40	23
2.3.6 Number of wall bioassays conducted after the completion of spraying at monthly intervals to evaluate insecticide decay	Total number of wall bioassay studies conducted at monthly intervals in established sentinel sites to evaluate the rate of insecticide decay on sprayed surfaces	Y1, Y2, Y3	*Data source:* Entomological reports Reporting frequency: *Per spray campaign*	By Spray Campaign	PMI	16	16	40	23

[2] Nassarawa Eggon tested pyrethroids, organophosphates, carbamates; Doma tested pyrethroids.

[3] All three sites (Nassarawa Eggon, Doma and Lafia) tested pyrethroids, organophosphates, carbamates.

Performance Indicator	Indicator Definition	Project Year(s) Reporting	Data Source(s) and Reporting Frequency	Disaggregate	PMI/ AIRS Indicator	Annual Targets and Results			
						Year 1		Year 2	
						Target	Result	Target	Result
2.3.7 Number of vector susceptibility tests for different insecticides conducted in selected sentinel sites	Total number of vector susceptibility tests conducted to gauge the effectiveness of individual insecticides proposed for use in spray operations	Y1, Y2, Y3	Data source: Entomological reports Reporting frequency: Per spray campaign	By Spray Campaign By Type of Insecticide[4]	PMI	1	1	1	Scheduled for September 2013
2.4 Conduct Communications Activities and Community Mobilization									
2.4.1 Number of radio spots and talk shows aired	Total number of radio spots and talk shows aired in target spray districts to stress the safety and benefits of IRS, ensure successful spray coverage, timely vacating of premises and adherence to IRS safety precautions by community members	Y1, Y2, Y3	Data source: Project records Reporting frequency: Semi-annually	By Spray Campaign	AIRS	N.A.	65 radio spots, 1talk show	90 radio spots, 3 talk shows	72 radio spots, 1 talk show
2.4.2 Number of IRS print materials disseminated	Total number of IRS educational materials developed, printed and distributed to community members in target spray districts using AIRS Project resources	Y1, Y2, Y3	Data source: Project records Reporting frequency: Semi-annually	By Spray Campaign By Type of printed material and message(s)	AIRS	N.A.	1,125; 725 t-shirts, 400 caps/hats	N.A.	1,996; 996 T-shirts, 1,000 caps
2.4.3 Number of people reached with IRS messages via door-to-door mobilization	Total number of adults reached with IRS message during pre-spray community, door-to-door mobilizaiton	Y1, Y2, Y3	Data source: Moblilization Data Collection Forms Reporting frequency: Daily per moblization conducted	By Spray Campaign By Gender	AIRS	N.A.	274,801; 141,501 females, 133,300 males	274,801; 141,501 females, 133,300 males	214,067; 111,312 females 102,755 males
2.5 Spray Targeted Structures According to Technical Specifications									
2.5.1 Number of structures targeted for spraying[5]	Total number of structures found in targeted spray districts by Spray Operators	Y1, Y2, Y3	Data source: Daily Spray Operator Forms	By Spray Campaign	PMI	100,000[6]	59,229	60,000	64,191

[4] One site conducts vector susceptibility tests for organophosphates, carbamates, and pyrethroids.

[5] The yearly targets for this indicator are from the applicable work plan. The yearly results are the number of structures found by Spray Operators during the campaign.

Performance Indicator	Indicator Definition	Project Year(s) Reporting	Data Source(s) and Reporting Frequency	Disaggregate	PMI/ AIRS Indicator	Annual Targets and Results			
						Year 1		Year 2	
						Target	Result	Target	Result
			Reporting frequency: Daily per spray campaign						
2.5.2 Number of structures sprayed with IRS[7]	Total number of structures sprayed in targeted districts	Y1, Y2, Y3	Data source: Daily Spray Operator Forms Reporting frequency: Daily per spray campaign	By Spray Campaign	PMI	85,000	58,704	55,250	62,592
2.5.3 Percentage of total structures targeted for spraying that were sprayed with a residual insecticide (Spray Coverage)	[Numerator: Total number of structures sprayed in targeted districts] [Denominator: Total number of structures in targeted areas found by spray operators] Calculation: [Numerator ÷ Denominator] x 100	Y1, Y2, Y3	Data source: Daily Spray Operator Forms Reporting frequency: Daily per spray campaign	By Spray Campaign	PMI	85%	99.1%	85%	97.5%
2.5.4 Number of people residing in structures sprayed (Number of people protected by IRS)	Total number of people residing in structures sprayed (Actual numbers are collected during spray operations; population estimates are not used.)	Y1, Y2, Y3	Data source: Daily Spray Operator Forms Reporting frequency: Daily per spray campaign	By Spray Campaign By Number of pregnant women By Number of children <5 years old	PMI	330,400	346,115; 15,900 pregnant women, 62,984 children <5	346,115; 15,900 pregnant women, 62,984 children <5	346,798; 16,733 pregnant women 67,204 children <5
Component 3: Provide ongoing monitoring and evaluation and quality control measures									
3.1 Submit Monitoring and Evaluation Plan (MEP) to PMI-Nigeria	*Milestone:* (Completed/Not Completed)	Y1, Y2, Y3	Data source: Project records		AIRS	Completed	Completed	Completed	Completed

[6] Targeted structures for the 2012 and 2013 spray rounds include *living structures only*. See *Nigeria's Structure Definition Document* for more detail.
[7] The target per year for this indicator is based on 85% of the number of structures to be targeted as noted in the applicable work plan.

Performance Indicator	Indicator Definition	Project Year(s) Reporting	Data Source(s) and Reporting Frequency	Disaggregate	PMI/ AIRS Indicator	Annual Targets and Results			
						Year 1		Year 2	
						Target	Result	Target	Result
			Reporting frequency: Semi-annual						
3.2 Submit a post-spray data quality audit report to the M&E Specialist in the AIRS Home Office within 60-180 days of completion of spray operations	*Milestone*: (Completed/Not Completed)	Y1, Y2, Y3	Data source: Spray Data Quality Report Reporting frequency: Per spray campaign	By Spray Campaign	AIRS	N.A.	Completed	N.A.	N.A.
3.3 Submit a country-specific Eligible Structure Definition Document to local PMI and NMCP	*Milestone:* (Completed/Not Completed)	Y1	Data source: Project records Reporting frequency: Semi-annually		AIRS	Completed	Completed	N.A.	N.A.
3.4 Supply chain review conducted by RTT	Milestone: (Completed/Not Completed)	Y1, Y2	Data source: RTT supply chain review reports Reporting frequency: Semi-annually	By Spray Campaign	AIRS	Completed	N.A.	TBD	N.A.
Component 4: Contribute to Global IRS Policy-Setting and Country-Level Policy Development of Evidence-Based IRS; Disseminate Experiences and Best Practices									
4.1 Number of guidelines/checklists/tools related to IRS operations developed or refined with project support	Total number of implementation guidelines, process checklists and program tools related to IRS operations developed or refined using the technical and/or financial resources of the AIRS Project	Y1, Y2, Y3	Data source: Project records – Activity reports Reporting frequency: Semi-annually	By Guideline/checklist/tool	AIRS	N.A.	2 Type: supervisory checklist, household questionnaire	2 Type: spray operations and IRS implementation manuals	2[8]

[8] M&E and other IRS training/guidelines tools for NMCP

Performance Indicator	Indicator Definition	Project Year(s) Reporting	Data Source(s) and Reporting Frequency	Disaggregate	PMI/ AIRS Indicator	Annual Targets and Results			
						Year 1		Year 2	
						Target	Result	Target	Result
4.2 Number of articles/best practices documents published	Total number of articles or other best-practice documents that have been published in relevant journals or through PMI/USAID communications vehicles	Y2, Y3	Data source: EOSR Reporting frequency: Semi-annually	By Spray Campaign By IRS Technical Area	AIRS	N.A.	N.A	2 Technical Area: M&E and entomology	2 Technical Area: M&Eand Entomology
4.3 Number of best practice presentations given at national/ regional/international workshops and conferences	Total number of project-related oral and poster presentations delivered in national, regional and/or international meetings related to IRS.	Y2, Y3	Data source: Project records – Activity reports Reporting frequency: Semi-annually	By IRS Technical Area	AIRS	N.A.	N.A.	2 Type: TBD	2 Type: IRS National Best Practices Training; Entomology
Component 5 (Cross-cutting): Capacity Building, Knowledge Transfer, Gender Inclusion									
5.1 Capacity Building[9] (Gender Inclusion)									
5.1.1 Number of people trained in IRS implementation	Total number of personnel trained in IRS implementation using AIRS Project resources. This figure only includes spray personnel such as spray operators, team leaders, supervisors, clinicians; it excludes data clerks, IEC mobilizers, drivers, washers, porters, pump technicians, security guards, etc.	Y1, Y2, Y3	Data source: Project records – Training reports Reporting frequency: Semi-annually	By Spray Campaign By Gender Percentage of Women Trained	PMI	N.A.	351; 60 females, 291 males, 17% women	375; 75 females, 300 males, 20% women	379; 53 females, 326 males 14.0% women
5.1.2 Number of people trained to deliver or support IRS in target districts	Total number of people trained using AIRS Project resources to implement/support elements of IRS in target districts. This figure includes all cadre that serve a role in IRS.	Y1, Y2, Y3	Data source: Project records – Training reports Reporting frequency: Semi-annually	By Spray Campaign By Gender By Role (e.g., spray operator,	AIRS	N.A.	626; 108 females, 518 males, 17% women	636; 127 females, 509 males, 20% women	653; 106 females, 547 males, 16% women

[9] See Appendix B for the disaggregation of trained AIRS staff for indicators under section 5.1 Capacity Building.

Performance Indicator	Indicator Definition	Project Year(s) Reporting	Data Source(s) and Reporting Frequency	Disaggregate	PMI/ AIRS Indicator	Annual Targets and Results			
						Year 1		Year 2	
						Target	Result	Target	Result
				storekeeper) Percentage of women trained					
5.1.3 Number of personnel trained as IRS implementation trainers	Total number of personnel trained in Training of Trainers (TOT) for IRS delivery	Y1, Y2, Y3	Data source: Project records – Training reports Reporting frequency: Semi-annually	By Spray Campaign By Gender Percentage of women trained	AIRS	N.A.	58; 8 females, 50 males, 14% women	58; 8 females, 50 males, 14% women	58; 2 females, 56 males, 3% women
5.1.4 Number of government environmental and/or health officials trained in IRS oversight	Total number of national and sub-national/district government environmental and/or health officials who are trained in oversight of IRS implementation using AIRS Project resources	Y1, Y2, Y3	Data source: Project records – Training reports Reporting frequency: Semi-annually	By Spray Campaign By Gender Percentage of Women Trained Type of government official (e.g. environmental/health)	AIRS	N.A.	7; 7 males 0% women Type: NESREA: 5 FMEnv: 2	16; 1 female, 15 males 6% women Type: NESREA: 5 FMEnv: 2 Doma local: 4 NE local: 4 NMCP:1	16; 6 females, 10 males 37.5% women trained Type: NESREA: 4 FMEnv: 2 Doma LGA: 3 NE LGA: 4 SMoH: 2 NMCP: 1
5.1.5 AIRS conducted a capacity assessment	AIRS Nigeriaprogram conducted an assessment of IRS capacity among national and sub-national/district government health officials	Y1, Y2	Data source: Project records – Capacity assessment reports Reporting frequency: Semi-annually		AIRS	Completed	In process	Completed	Completed
5.1.6 Number of	Total number of Memoranda of	Y1, Y2,	Data source: Project	By Spray	AIRS	1	1	1	0

Performance Indicator	Indicator Definition	Project Year(s) Reporting	Data Source(s) and Reporting Frequency	Disaggregate	PMI/ AIRS Indicator	Annual Targets and Results			
						Year 1		Year 2	
						Target	Result	Target	Result
capacity-building MOUs signed by AIRS, NMCP and partners/ institutions	Understanding (MOU) on provision of local capacity building finalized and signed between AIRS, the Malaria and Other Parasitic Diseases Division (MOPPD), and other local partners and institutions	Y3	records – MOUs Reporting frequency: Semi-annually	Campaign					