



U.S. PRESIDENT'S MALARIA INITIATIVE



THE PMI VECTORLINK PROJECT ETHIOPIA

2019 END OF SPRAY REPORT

SPRAY CAMPAIGN: MAY 20, 2019 – JULY 22, 2019

Recommended Citation: The PMI VectorLink Project. September 2019. *Ethiopia 2019 End of Spray Report. Spray Campaign: May 20 2019 – July 22, 2019.* Rockville, MD. The PMI VectorLink Project, Abt Associates Inc.

Contract: AID-OAA-I-17-00008

Task Order: AID-OAA-TO-17-00027

Submitted to: United States Agency for International Development/PMI

Submitted on: September 3, 2019

Approved on: October 15, 2019

Abt Associates Inc. | 6130 Executive Blvd | Rockville, Maryland 20814
T. 301.347.5000 | F. 301.913.9061 | abtassociates.com

The views expressed in this document do not necessarily reflect the views of the United States Agency for International Development or the United States Government.

THE PMI VECTORLINK PROJECT ETHIOPIA

2019 END OF SPRAY REPORT

SPRAY CAMPAIGN: MAY 20, 2019 – JULY 22, 2019



CONTENTS

Acronyms	i
Executive Summary	1
1. Country Background	3
2. Pre-Season Activities	5
2.1 Selection of Target Districts and Kebeles	5
2.2 Enumeration and Setting Targets.....	6
2.3 District Planning Meetings	6
2.4 Insecticide Selection.....	7
2.5 Logistics Needs Assessment	7
2.6 Procurement.....	7
2.7 Human Resources.....	8
2.8 Training	9
3. Information, Education, and Communication	11
3.3 Community Meetings and Dialogue	13
4. Implementation of IRS Activities	14
4.2 Logistics and Inventory Control.....	16
4.3 IRS Campaign Results	17
4.4 Security.....	18
5. Entomological Monitoring	21
6. Monitoring and Evaluation	22
6.1 Key Objectives	22
6.2 Data Collection.....	22
6.3 Dimagi Platform.....	23
6.4 Data Quality Assurance Protocols.....	23
6.5 Data Entry	24
6.6 Data Storage and Cleaning.....	24
7. Environmental Compliance	25
7.1 Pre-Season Environmental Compliance Assessment	25
7.2 Follow-up Environmental Compliance Inspections.....	26
7.3 Pre-Contract Motor Vehicle Inspections And Drivers Training.....	26
7.4 Medical Clearances.....	26
7.5 Training of Clinicians in Management of Insecticide Poisoning.....	26
7.6 Mid-spray Environmental Compliance Inspections.....	26
7.6.1 Environmental compliance audit.....	27
7.6.2 Morning mobilization, homeowner preparations and sop performance.....	27
7.6.3 Storekeeper performance inspections	27
7.6.4 End-of-day clean-up inspections.....	27
7.7 Incidents.....	27

7.8 Post-season Environmental Assessment	28
7.8.1 Solid waste disposal	28
7.8.2 Liquid waste disposal	28
8. Gender Mainstreaming.....	29
9. Capacity Building	31
10. Post-spray Activities	33
10.1 Post-Spray Inventory.....	33
10.2 Post-Spray Review Meetings	33
11. Challenges and Lessons Learned	34
11.1 Challenges.....	34
11.2 Lessons Learned and Recommendations	35
Annex A: Adjusted Structure Target for Gambela Region	37
Annex B: Procurement.....	38
Annex C: Dates and Duration of Spray Campaign by District	41
Annex D: Insecticide Usage.....	43
Annex E: Spray Progress and Coverage by District and by Region	45
Annex F: M&E Plan Matrix – 2019 Campaign Results	53
Annex G: Environmental Mitigation and Monitoring Report	71

LIST OF TABLES

Table ES-1: Summary of 2019 PMI VectorLink IRS Campaign.....	1
Table 1: PMI Support for IRS in Ethiopia, 2015 to 2019	4
Table 2: Number of Kebeles Targeted for IRS by VectorLink Ethiopia in 2019 by Zone	5
Table 3: Hiring by PMI VectorLink Ethiopia for 2019 IRS Campaign.....	8
Table 4: Type, Description, and Duration of Trainings.....	9
Table 5: Number and Type of Seasonal Workers Trained, by Gender and Job Category.....	10
Table 6: Results of IRS Mobilization	12
Table 7: Regional Spray Progress and Coverage.....	17
Table 8: Kebeles that were affected by Security.....	19
Table 9: Use of Data Collection Verification Form: Common Issues and Corrective Actions.....	23
Table 10: Number of Completed Supervision Checklists.....	27
Table 11: Environmental Incidents Reported during the 2018 IRS Campaign	28
Table 12: Summary of Type, Quantity, and Disposal Stream of 2019 IRS Solid Waste.....	28
Table 13: Female Engagement in IRS Implementation by Region.....	30
Table A-1: Adjusted Structure Target for Gambela Region.....	37
Table B-1: International Procurements	38
Table B-2: Local Procurements	39
Table C-1: Campaign Length by District.....	41
Table D-1: Insecticide Usage by District.....	43
Table E-1: Spray Progress and Coverage by District.....	45
Table G-1: Environmental Mitigation and Monitoring Report.....	71

LIST OF FIGURES

Figure 1: Districts receiving IRS through PMI VectorLink in 2019	3
Figure 2: IEC poster that was used to mobilize the community for IRS.....	11
Figure 3: On the left, SQL transferring key messages on importance of house preparation to householders and on the right, a well-prepared house ready for spraying.....	13
Figure 4: Signs of good household preparation: Personal items stored outdoors and completely empty structures	16
Figure 5: Reasons for unsprayed structures.....	18
Figure 6: Mortality of insectary <i>An. arabiensis</i> in WHO cone bioassays in Lare, Abaya, and Bambasi (May–July 2019)	21
Figure 7: PMI VectorLink Ethiopia poster on anti-sexual harassment	30
Figure E-1: Regional Spray Progress.....	49
Figure E-2: Regional Spray Coverage	49
Figure E-3: Zonal Spray Progress, Gambela Region	50
Figure E-4: Zonal Spray Coverage, Gambela Region.....	50
Figure E-5: Zonal Spray Progress, Benishangul-Gumuz Region	51
Figure E-6: Zonal Spray coverage, Benishangul-Gumuz Region.....	51
Figure E-7: Zonal Spray Progress, Oromia Region.....	52
Figure E-8: Zonal Spray Coverage, Oromia Region	52

ACRONYMS

BMP	Best Management Practices
COP	Chief of Party
DCV	Data Collection Verification
DEC	Data Entry Clerk
DHO	District Health Office
DOS	Directly Observed Spraying
ECO	Environmental Compliance Officer
ECOS	Environmental Compliance Operations Support
EPHI	Ethiopian Public Health Institute
FEFO	First to Expire First Out
FMOH	Federal Ministry of Health
HEW	Health Extension Worker
IEC	Information, Education and Communication
IRS	Indoor Residual Spraying
M&E	Monitoring and Evaluation
MEP	Monitoring and Evaluation Plan
MFP	Malaria Focal Person
MSP	Mobile Soak Pits
NMCP	National Malaria Control Program
PMI	President's Malaria Initiative
PPE	Personal Protective Equipment
PSECA	Pre-Season Environmental Compliance Assessment
RHB	Regional Health Bureau
SBCC	Social Behavior Change Communication
SEA	Supplementary Environmental Assessment
SOP	Spray Operator
SQL	Squad Leader
STTA	Short-Term Technical Assistance
TL	Team Leader
TOT	Training of Trainers
USAID	United States Agency for International Development

EXECUTIVE SUMMARY

Abt Associates supports the implementation of indoor residual spraying (IRS) in Ethiopia through the PMI VectorLink Project funded by the United States Agency for International Development (USAID) under the U.S. President’s Malaria Initiative (PMI). The objective of the PMI VectorLink Project is to support the planning and implementation of IRS programs, and other proven life-saving malaria vector control interventions. To achieve this objective, VectorLink Ethiopia, in collaboration with the Federal Government of Ethiopia, conducted IRS from May 20 to July 22, 2019. VectorLink Ethiopia targeted 542,148 structures across 44 districts using the organophosphate, Actellic 300CS; the target was later revised to 509,594 structures as a result of security issues prohibiting teams from reaching certain areas. The spray campaign took place from May 20 to June 15 in Gambela Region, and from June 3 to July 22 in Oromia and Benishangul-Gumuz regions. The campaign in Benishangul-Gumuz extended beyond the original end date as a result of security concerns, which pushed back the start date in 11 districts of the region and caused interruptions in several others. The campaign results are summarized in Table ES-1.

Table ES-1: Summary of 2019 PMI VectorLink IRS Campaign

Dates of PMI-supported IRS campaign	May 20–July 22, 2019
Total calendar days	64*
Insecticides used	Actellic 300CS (organophosphate)
Number of regions	3 (Benishangul-Gumuz, Gambela, and Oromia)
Number of districts	44
Number of structures found by SOPs	510,449
Number of structures sprayed by SOPs	487,746
2019 spray coverage	95.5%
Population protected	Total population: 1,334,868 Children under 5 years: 228,262 (17.1%) Pregnant women: 33,245 (2.5%)
Number of people trained with U.S. Government funds to deliver IRS**	2,297

* This is the total number of calendar days for the 2019 campaign. The exact number of operational days for each district is in Annex C.

** Based on the definition of the indicator “Number of people trained with USG funds to deliver IRS”, spray personnel trained to deliver IRS only include spray personnel such as spray operators, team leaders, and supervisors. Clinicians, data clerks, IEC mobilizers, drivers, washers, porters, pump technicians and security guards were excluded.

Below are the key project achievements and highlights during the 2019 spray campaign:

- Completed digital structure enumeration and ground truthing exercise in Gambela Region and verified the existence of a total of 133,080 eligible structures out of 239,935 structures found by satellite maps.
- Sprayed 487,746 structures out of 510,449 structures found by spray operators, resulting in 95.5% spray coverage. This represents 90.0% spray progress relative to the original target of 542,148 structures and 95.7% spray progress compared with the adjusted target of 509,594. In total, 1,334,868 residents were protected, including 228,262 children under 5 years old (17.1% of residents protected) and 33,245 pregnant women (2.5%).

- Trained 2,297 individuals to deliver IRS¹ in 44 districts. Of these, 292 were supervisors, 1,361 were spray operators, and 644 were squad leaders. Women accounted for 26.9% of *all staff trained*,² and 10.5% of supervisory positions.
- A total of 121,768 bottles of insecticide were used to spray 487,746 structures, with an average utilization ratio of approximately 4.0 structures sprayed per bottle.
- Conducted wall bioassays within 24 to 48 hours of spraying and recorded 100% mortality of susceptible *Anopheles arabiensis* in two out of three sites and 99% mortality in one site on wall surface types sprayed with Actellic 300CS.
- Began safely disposing of all IRS insecticide contaminated wastes, including empty Actellic bottles, empty Actellic boxes, and used face masks. Empty bottles and cardboard boxes will be recycled into non-consumable products. While used masks will be incinerated and worn-out PPEs will be given to SOPs in need after decontamination.

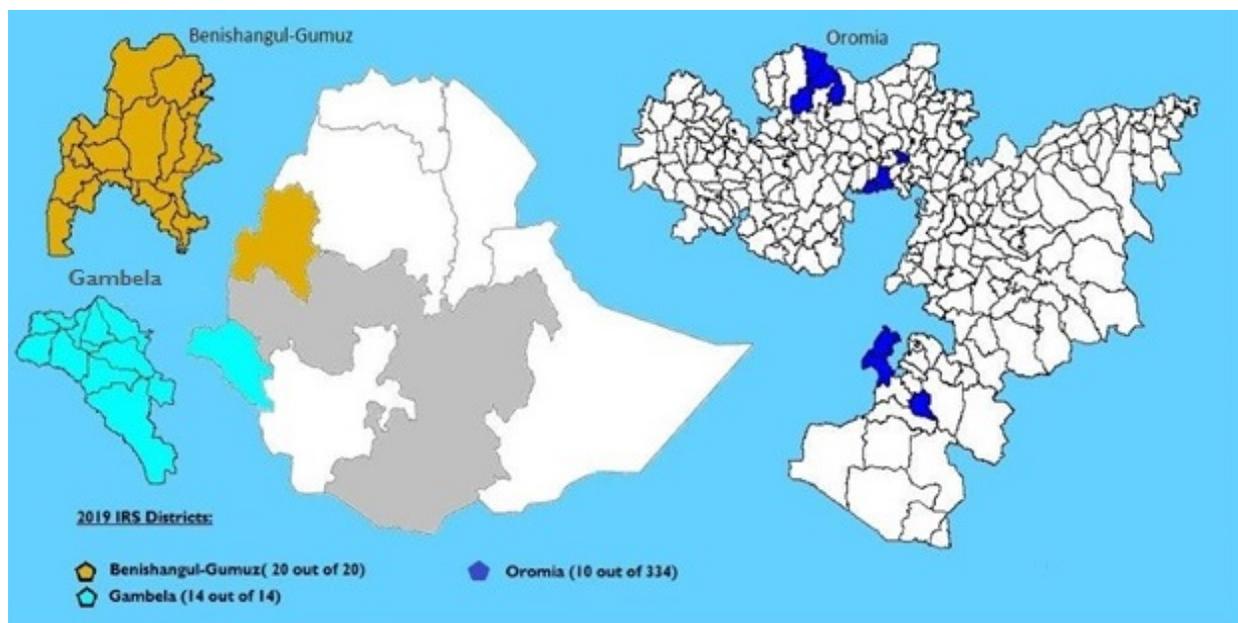
¹ Based on the definition of the indicator “Number of people trained with USG [U.S. Government] funds to deliver IRS,” spray personnel trained to deliver IRS only include spray personnel such as spray operators, team leaders, pump technicians and supervisors.

² This includes supervisors, mobilizers, squad leaders, spray operators, porters, data entry clerks, Monitoring and Evaluation (M&E) assistants, district storekeepers, washers, security guards, drivers, pump technicians, and clinicians.

I. COUNTRY BACKGROUND

The U.S. President's Malaria Initiative (PMI) has funded indoor residual spraying (IRS) in Ethiopia since 2008, with the aim of reducing the malaria burden, especially among children less than 5 years old and pregnant women. Under the PMI Africa Indoor Residual Spraying projects (2012–2017), Ethiopia successfully implemented six IRS campaigns. In each campaign, 36 districts in Oromia Regional State were sprayed. In 2017, the project conducted IRS in an additional eight districts in the Benishangul-Gumuz region. In 2018, PMI Ethiopia asked that VectorLink Ethiopia graduate 26 of 36 districts in Oromia Region and replace them with 26 districts in Benishangul-Gumuz and Gambela regions. The same 44 target districts – 20 out of 20 districts in Benishangul-Gumuz, 14 out of 14 districts in Gambela, and 10 out of 334 districts Oromia – were targeted again in 2019 and are shown in Figure 1. The number of targeted structures (Table 1) was determined in collaboration with government counterparts using population estimates, historical IRS data were available, and, in the case of Gambela region in 2019, digital enumeration.

Figure 1: Districts receiving IRS through PMI VectorLink in 2019



Malaria transmission in Ethiopia occurs up to 2,000 meters above sea level but has been reported to occur in areas up to 2,300 meters under abnormal weather conditions. The country's diverse ecology supports a wide range of transmission intensities. At least 75% of the country is malarious with about 60% (more than 50 million people) of the total population living in areas at risk of malaria. Annually, 4–5 million people are affected by malaria, which in Ethiopia is caused primarily by *Plasmodium falciparum* and *P. vivax* parasites. Malaria transmission peaks twice per year, from September to December, after the long rainy season, and from April to May, after a shorter rainy season. *Anopheles arabiensis* is the predominant malaria vector; *An. pharoensis*, *An. funestus*, and *An. nili* play a much lesser role in transmission. IRS is one of the vector control interventions that are used in the country to combat malaria.

Under the National Malaria Strategic Plan 2017–2020, the Federal Ministry of Health (FMOH) targets IRS to areas where the malaria burden is high, and highland fringe areas at risk of epidemic.

In 2019, the VectorLink Ethiopia project worked with the FMOH, the Benishangul-Gumuz, Gambela, and Oromia regional health bureaus (RHBs), and the district health offices (DHOs) to conduct IRS in the 44 target districts, originally targeting 542,148 structures using Actellic 300CS. Over the course of the 2019 campaign, the target was adjusted to 509,594 due to security issues prohibiting teams from reaching certain areas. A total of 487,746 structures were sprayed out of 510,449 structures found by spray operators (SOPs) accounting for a coverage rate of 95.5%. As a result, the project achieved 90% spray progress relative to the original target and 95.5% spray progress compared to the adjusted target of 509,594. In total, 1,334,868 residents were protected including 228,262 children under 5 years old and 33,245 pregnant women.

Table I provides a summary of United States Agency for International Development (USAID) and PMI support to IRS in Ethiopia since 2015.

Table I: PMI Support for IRS in Ethiopia, 2015 to 2019

	2015	2016	2017	2018	2019
Number of districts covered by PMI-supported IRS	36 (Oromia)	36 (Oromia)	44 (36 in Oromia, 8 in Benishangul-Gumuz)	44 (10 in Oromia, 20 in Benishangul-Gumuz, and 14 in Gambela)	44 (10 in Oromia, 20 in Benishangul-Gumuz, and 14 in Gambela)
Number of structures targeted	670,303	708,258	787,658	Original: 595,618 Adjusted: 574,042	Original: 542,148 Adjusted: 509,594
Number of structures found by SOPs	708,258	717,396	748,917	485,358*	510,449
Number of structures sprayed	704,945	715,541	738,810	472,569	487,746
Spray coverage (%)	99.5	99.7	98.7	97.4	95.5
Population protected	1,655,997	1,688,745	1,877,154	1,264,189	1,334,868
Children under 5	230,366	230,690	269,299	213,459	228,262
Pregnant women	23,084	23,011	29,271	28,944	33,245
Spray dates and insecticide used	July–Aug: Actellic 300CS Aug–Sep: Bendiocarb 80 WP	Jun–Aug: Actellic 300CS	Jun–Jul: Actellic 300CS	May–Jul: Actellic 300CS	May–Jul: Actellic 300CS
Number of people trained with U.S. Government funds to deliver IRS	2,845	2,749	3,199	2,413	2,675

*The number of structures found by SOPs was low due to overestimation of the target number of eligible structures (estimated based on government data) and security concerns in some districts.

2. PRE-SEASON ACTIVITIES

The VectorLink Ethiopia project and the Benishangul-Gumuz, Gambela, and Oromia regional states systematically worked together to ensure a smooth planning process. The team used the existing government structure and systems to implement IRS activities and promote sustainability of the program. DHO heads and district malaria focal persons (MFPs) led IRS implementation and management in their districts with support and leadership from the regional experts (Regional MFP and Malaria Technical Advisor).

Health Extension Workers (HEWs) and local community leaders were assigned the community mobilization activities. Health professionals at various district health system levels served as squad leaders (SQLs) and team leaders (TLs), supervisors, and trainers of SOPs. SOPs and about 20% of SQLs were recruited from within the target areas using IRS actor selection criteria and guidelines.

2.1 SELECTION OF TARGET DISTRICTS AND KEBELES

In 2019 the VectorLink Ethiopia project implemented IRS in the same 44 districts as in 2018, selected by PMI in collaboration with the FMOH – specifically, the National Malaria Control Program (NMCP) – based on districts’ malaria burden. In 2019, the project planned to conduct IRS in 885 out of 982 kebeles across the 44 target districts. During the micro-planning meeting, the stakeholders agreed to exclude 97 kebeles with either altitude above 2,000 meters or unstable security conditions. Table 2 shows the number of kebeles targeted for the 2019 campaign.

Table 2: Number of Kebeles Targeted for IRS by VectorLink Ethiopia in 2019 by Zone

Region	Zones	Total Number of Kebeles	Number of Kebeles Targeted to Receive IRS
Benishangul-Gumuz	Kamashi	64	58
	Assosa	217	217
	Metekel	173	155
	Maokomo Special	32	32
Gambala	Agnua	87	87
	Nuer	122	122
	Majang	40	40
	Itang Special	23	23
	Gambela Town	5	5
Oromia	Horo Guduru Wollega	92	57
	South West Shewa	65	45
	West Guji	62	44
Total		982	885

2.2 ENUMERATION AND SETTING TARGETS

During the 2018 IRS campaign, VectorLink set targets using a combination of historical IRS data and population data provided by the RHBs. Ultimately, in 2018 the spray teams found less than 85% of the expected number of structures overall, and about 69% of the expected number of structures in Gambela region. It was not clear if the unfound structures existed and were not captured by the spray teams or if the targets had been overestimated. Therefore, in 2019, VectorLink Ethiopia, in collaboration with the Gambela RHB, enumerated all eligible structures in the region's 14 PMI target districts with the support of Digital Globe maps.

The enumeration results indicated that the 2018 IRS campaign had not found all eligible structures in Gambela Region. The results also revealed communities that had not been visited or sprayed in 2018, and these were added to the 2019 target. Thus, targets were adjusted across all districts in Gambela. In districts where the enumerators found fewer eligible structures in 2019 than in 2018, the number of structures found in 2018 was maintained as the target. In the case of Gambela Town, the target was further adjusted due to large-scale refusals in urban areas during the 2018 IRS campaign. The project worked with the Gambela RHB and DHOs to ensure buy-in from local authorities and ultimately were advised to exclude 13 out of the 29 zones. Annex A shows the adjusted target number of structures based on enumeration results for Gambela Region.

The results of the structure enumeration also helped VectorLink appropriately allocate all necessary IRS materials and human resources for the 2019 IRS season.

The Oromia and Benishangul-Gumuz regions' targets were set based on structures found by SOPs in 2018.

2.3 DISTRICT PLANNING MEETINGS

In collaboration with the NMCP, the three RHBs, and the DHOs, PMI VectorLink organized a two-day planning meeting in March 2019 in each of the three regions. Each region had its own meeting, to fine tune plans for trainings, and identified commodity and human resources needs, as well as infrastructure, transportation, and management support needs.

Deliverables of the 2019 micro-planning meetings included:

- Timing and duration of spray operations;
- Confirmation of the number of kebeles to be covered (in Oromia region specifically);
- Presentation of gender inclusion in IRS including how to overcome specific barriers to women's participation and local targets for hiring women at various levels;
- Dissemination and review of the structure enumeration results;
- Details confirming the number and location of storage facilities and soak pits, and requirements for SOPs, washers, SQLs, TLs, and supervisors;
- Confirmation of the final spray schedule, including training, logistics/deliveries, and communication/mobilization activities;
- Confirmation of spray personnel terms of reference and operational budgets;
- Supervision, monitoring, and reporting plans; and
- Plan for medical check-ups of all spray actors, including pregnancy tests for all women.

2.4 INSECTICIDE SELECTION

Ethiopia has an insecticide resistance management structure that uses entomological studies to select insecticides to be used in the country. The Technical Advisory Committee, which meets twice per year, recommended the use of Actellic 300CS, an organophosphate, for the 2019 spray campaign in all 44 districts. The selection was based on data obtained from insecticide susceptibility tests conducted from 2014 to 2018, which showed that the main malaria vector, *An. gambiae* s.l., is susceptible to pirimiphos-methyl (Actellic 300CS) in all sites where the testing was done. Documented data on the residual life of Actellic 300CS in Ethiopia were also taken into consideration. Decay rate evaluation results from 2015 to 2017 indicated that the residual life of Actellic 300CS was 2–6 months depending on wall surface types. Additionally, Actellic 300CS is among the insecticides approved for public health use in Ethiopia by the Ministry of Agriculture.

2.5 LOGISTICS NEEDS ASSESSMENT

The PMI VectorLink Ethiopia conducted logistics needs assessments in September 2018 to determine the following:

- Materials, consumables, and equipment needs
- Transportation requirements, including hiring vehicles for spray operations and supervision
- Estimates of personal protective equipment (PPE) and spray equipment required
- Appropriate supply and equipment mobilization and distribution plans

The results of the logistics needs assessment were used to procure IRS commodities needed for the 2019 IRS season. See Annex B for the details on international and local procurements as well as material distribution plans.

2.6 PROCUREMENT

VectorLink Ethiopia procured both international and local commodities for the 44 PMI-supported IRS districts and 60 graduated districts (in which IRS was formerly supported by PMI). (See Annex B for full list). The procurement and logistics team, in close collaboration with the technical teams, coordinated the procurement and shipment of IRS supplies. The project conducted all local procurements based on USAID and Abt's standard procedures.

Based on previous insecticide consumption rates and the number of eligible structures, the team estimated that 147,467 Actellic 300CS bottles was sufficient for the 2019 IRS campaign. Since the project had a balance of 97,467 bottles from the 2018 spray campaign, which had an expiration date of 1 February 2020, VectorLink Ethiopia procured an additional 50,004 bottles for 2019. The project benefited from NGenIRS/UNITAID co-funding for the insecticide procured in both 2018 and 2019.

The VectorLink Ethiopia team ensured early procurement and distribution of IRS commodities to avoid the logistical challenges that characterized the 2018 spray season. A distribution plan, based on the needs of each district, was prepared by the VectorLink Ethiopia operation managers in collaboration with the logistics coordinator and environmental compliance officer (ECO) to ensure proper tracking of IRS commodities. Specifically, all IRS commodities including insecticides were delivered to operations sites at least one week before spraying started.

Regarding the procurement of rental vehicles for IRS, the project procured fewer vehicles from a larger number of vendors so that each vendor had a more manageable fleet involved in IRS. All the vehicles were inspected at least one week before the IRS campaign started, which reduced delays.

2.7 HUMAN RESOURCES

The VectorLink Ethiopia team worked with each district to recruit seasonal spray actors based on the recruitment criteria developed by the VectorLink project in partnership with the three RHBs. In 2019, the criteria were revised to include a broader age range, females were encouraged to apply, and also education status data were collected to determine the viability of SOPs collecting data instead of SQLs. This revealed that out of 1,156 SOPs that submitted their information, 79.6 percent completed their 10th grade and therefore assumed to be able to write and read in English. The VectorLink team was involved in the hiring process either through zonal coordinators or seasonal supervisors.

The number of spray teams was determined according to the number of structures to be covered in the districts. The district spray teams included at least one TL, who was in charge of 4–5 squads and each squad had two SQLs, four SOPs, and one porter, the latter of which served two squads. The district leadership teams comprised one MFP, one district ECO, one vice head, and one district information, education, and communication (IEC) officer, all of whom were full-time DHO employees. In addition to the DHO staff, VectorLink Ethiopia hired one additional seasonal supervisor to strengthen the quality of supervision in Benishangul-Gumuz and Gambela regions. For the first time, the project also hired monitoring and evaluation (M&E) assistants whose main responsibility was to conduct routine data collection verification (DCV); DCVs were previously conducted by MFPs. The nine VectorLink zonal IRS coordinators, who are full-time Abt staff, were each responsible for 3–5 districts.

VectorLink Ethiopia recruited and hired 4,784 individuals to carry out and support IRS operations in all the 44 target districts. As Table 3 shows, the staff that implemented IRS in the operations sites included 292 government supervisors and TLs, 29 seasonal supervisors, 644 SQLs, 1,361 SOPs, and 334 porters. Other seasonal support staff were 45 data entry clerks (DECs), 44 M&E assistants, 44 storekeepers, and 44 storekeepers' assistants, who also served as pump technicians. One hundred and eight washers, 96 water fetchers and 87 security guards provided IRS support at the operations site level. Lastly 1,656 mobilizers were hired to conduct door-to-door mobilization across the 44 target districts.

Of these 4,784 seasonal staff, 27.9% were women; out of the 1,361 people hired as SOPs, 3.6% were women.

Table 3: Hiring by PMI VectorLink Ethiopia for 2019 IRS Campaign

Category	Number of Staff Hired to Support IRS*						Total (% Female)
	Spray Ops		Data Capture		Other		
	M	F	M	F	M	F	
Supervisors	281	11	–	–	–	–	292 (3.8%)
Seasonal supervisors	28	1					29(3.4%)
Squad leaders	557	87	–	–	–	–	644(13.5%)
Spray operators	1312	49	–	–	–	–	1,361 (3.6%)
Porters	159	175					334 (52.4%)
Data entry clerks	–	–	42	3	–	–	45 (6.7%)
M&E assistants	–	–	43	1	–	–	44 (2.3%)
Storekeepers	–	–	–	–	41	3	44 (6.8%)
44 Store assistants/Pump technicians	–	–	–	–	44	0	44 (0.0%)
Washers					0	108	108 (100.0%)
Water fetchers					56	40	96 (41.7%)
Security guards					87	0	87 (0.0%)
Mobilizers	–	–	–	–	797	859	1,656 (51.9%)
TOTAL M/F	2,337	323	85	4	1,025	1,010	4,784 (27.9 %)
TOTAL	2,660		89		2,035		

* Supervisors and storekeepers are Government of Ethiopia staff.

2.8 TRAINING

Before spray operations began, VectorLink Ethiopia collaborated with the RHBs and DHOs to train personnel involved in IRS. Training on IRS implementation and supervision is central to the overall capacity-building strategy of the PMI VectorLink project. A variety of trainings were held to develop and/or refresh skills of IRS personnel on IRS implementation for the 2019 IRS campaign.

Table 4 lists each type of IRS training conducted, a description of topics it covered, and its duration. Table 5 shows the number of people trained, disaggregated by gender.

Table 4: Type, Description, and Duration of Trainings

Type	Description of Training	Duration
Training of Trainers/ Supervisors	Participants included district MFPs and supervisors at regional, zonal, and district level. The training prepared trainers to train seasonal workers (SOPs, SLs, porters, and community mobilizers). The emphasis was to ensure that trainers were able to effectively explain and demonstrate current IRS best practices. The supervision component was improved to ensure effective supervision for the 2019 IRS season.	5 days
Squad leaders	SQLs were recruited by DHOs in collaboration with VectorLink Ethiopia. The training built the capacity and skills of SQLs to lead a team of at least 2 SOPs to ensure that spraying was completed on schedule and delivered with a high degree of quality. SQLs were also trained in recording and reporting spray data, with a particular emphasis on the importance of recording unsprayed structures. SQLs were trained with SOPs for the first 4 days and were then split for the next 2 days to receive a training focusing on IRS data collection and supervision.	6 days
Spray operators	VectorLink Ethiopia designed this training to build upon SOPs' capacity to conduct IRS and effectively communicate with householders. In particular, the training emphasized the importance of finding all eligible structures and conducting high-quality IRS. Other topics covered were: introduction to malaria control, spray techniques, handling insecticides and spray pumps, personal and environmental safety, data collection forms, and the basics of IEC for IRS.	6 days
Data entry clerks	DECs were trained on the following topics: familiarity with data collection forms (Daily Spray Operator and Team Leader forms, and the Spray Quality Checklist), understanding key IRS definitions (e.g., eligible structure) and indicators and responsibilities, reviewing collected data and spotting irregularities, timely, consistent, and accurate reporting, setting appropriate and realistic reporting timelines, and establishing back-up reporting/ communication protocols and VectorLink database and security protocols.	4 days
M&E assistants	M&E assistants were trained on all VectorLink data collection and verification forms as well as the VectorLink Ethiopia supervisory toolkit. They were also trained on key IRS definitions (e.g., eligible structure), indicators, staff responsibilities, communication protocol, and review and reporting (quality assurance) of collected data in a timely, consistent, and accurate manner. Furthermore, they were oriented on the VectorLink Ethiopia database and security protocols.	5 days
Storekeepers	One storekeeper from each target district were trained on store and inventory management, including chain of command protocols, limiting authorized entry, and use of stock cards.	3 days
Spray pump technicians /Store assistants	Spray pump technicians were recruited by DHO in collaboration with VectorLink. The main responsibility of pump technicians was to ensure functionalizing of spray pumps. The training covered approaches on how to handle, clean, and maintain spray pumps. The technicians also receive skills that helped them handle problems on spray pumps and their parts. They had a dual-role: they also served as assistant storekeepers to reduce the number of site-level staff.	2 day
Clinicians	Clinicians were recruited from at least one key health facility from each target district. The training focused on insecticide poisoning management, poisoning prevention and mitigation practices, and health hazards and their management.	1 day
Community mobilizers	Community health workers were trained on how to increase the community's understanding of malaria, acceptance for IRS, and awareness of IRS spray schedule.	1 day
Drivers	Drivers contracted to transport IRS materials and personnel were trained on safety procedures. After completing the training, drivers and vehicles were registered and issued VectorLink-branded certificates of training as well as ID cards and decals for easy verification by supervisors.	1 day

Table 5: Number and Type of Seasonal Workers Trained, by Gender and Job Category

Category	Males	Females	Total (% Female)
Supervisors	191	8	199 (4.0%)
Team leaders	90	3	93 (3.2%)
Squad leaders	557	87	644 (13.5%)
Spray operators	1,312	49	1,361 (3.6%)
Porters	159	175	334 (52.4%)
Data entry clerks	48	6	54 (11.1%)
M&E assistants	43	1	44 (2.3%)
District storekeepers	39	0	39 (0.0%)
Assistant storekeepers/Pump technicians	44	0	44 (0.0%)
Clinicians	60	19	79 (24.1%)
Mobilizers	797	859	1,656 (51.9%)
Drivers	145	0	145 (0.0%)
Washer	0	108	108 (100.0%)
Security guard	87	0	87 (0.0%)
TOTAL	3,572	1,315	4,887 (26.9%)

3. INFORMATION, EDUCATION, AND COMMUNICATION

Due to gaps in mobilization identified in the 2018 IRS campaign, especially in Benishangul-Gumuz and Gambela, where IRS was implemented by PMI for the first time, PMI VectorLink Ethiopia employed a more systematic approach to mobilization in 2019. The project also worked closely with the PMI-supported Johns Hopkins Center for Communication Programs' Communication for Health project to review the existing IEC and Social Behavior Change Communication (SBCC) materials for IRS (posters and radio messages, etc.) and developed new, effective materials for mobilizers. VectorLink Ethiopia recruited two mobilizers per Kebele (among community leaders, Kebele administrators, and other influential persons in the community) to ensure effectiveness of mobilization. The project also ensured that messaging and training was sensitive to local gender and social norms, and promoted the inclusion of women in the IRS work force.

The mainstay for communicating IRS messages to the community in 2019 was door-to-door visits. VectorLink Ethiopia also communicated IRS messages at community meetings and through mass media and posters to promote acceptance. Figure 2 illustrates a poster showing a spray operator spraying eave of a structure. The text in the poster encourages the residents to allow the houses sprayed and discourages replastering after spraying. In all the regions, community-level communication activities began about two weeks prior to and continued throughout the campaign.

3.1 DOOR-TO-DOOR MOBILIZATION

VectorLink Ethiopia conducted door-to-door mobilization on May 6–11, 2019, in Gambela Region and on May 21–25, 2019, in Benishangul-Gumuz and Oromia regions. During this exercise, mobilizers communicated key IRS messages along with the expected spray dates to homeowners. They also distributed IRS structure cards for each eligible structure. Additionally, mobilizers collected data using the IEC Mobilizer form, filled, and issued an IRS card and marked the outside of each home with the IRS structure number from the IRS card issued, the date of mobilization, and mobilization status.

IRS messages for the 2019 spray campaign emphasized adherence to safety guidelines and addressed fears, concerns, and some misconceptions about IRS that are common in Ethiopia. The mobilizers encouraged the community

Figure 2: IEC poster that was used to mobilize the community for IRS



to support women to work for the PMI VectorLink project, to combat the misperception that female IRS actors are not as effective as men.

VectorLink Ethiopia mobilized a total of 195,837 households, with household respondents reporting a 98.7% IRS acceptance rate. Table 6 contains results of house-to-house mobilization efforts. IEC officers, with support from the VectorLink zonal IRS coordinators and MFPs, oversaw the implementation of this activity. They also reviewed the data collected and IRS cards issued to the structures to ensure accuracy and completeness.

VectorLink Ethiopia did not conduct door-to-door mobilization in Kamashi Zone or in Oda District of Assosa Zone due to security concerns. The primary vehicle for communicating IRS messages to the community in these districts was limited to mass communication and community meetings.

Table 6: Results of IRS Mobilization

Zone	Households		Population Reached			IRS		IEC/SBCC Materials Distributed
	Sensitized	Not Sensitized	Total	Males	Females	Acceptance	Non-Acceptance	
Agnuwa	13,438	673	58,706	28,443	30,263	13,279	159	730
Assosa*	30,699	928	131,554	62,766	68,788	30,516	183	1,880
Gambela Town	5,676	130	21,301	10,406	10,895	5,288	388	50
Horo Gudro Wellega	24,598	709	82,223	39,929	42,294	24,360	238	450
Itang Special	4,502	166	26,025	13,187	12,838	4,474	28	250
Kamashi*	-	-	-	-	-	-	-	480
Majang	8,859	751	30,399	15,104	15,295	8,738	121	300
Mao-Komo Special	8,555	276	30,765	14,737	16,028	8,501	54	290
Metekel	35,234	1,350	142,506	68,787	73,719	34,777	457	1,260
Nuer	13,866	50	74,364	37,122	37,242	13,719	147	1,000
South West Shoa	26,111	1,013	97,983	47,854	50,129	25,990	121	450
West Guji	24,299	1,141	149,091	76,391	72,700	23,827	472	430
Total	195,837	7,187	844,917	414,726	430,191	193,469	2,368	7,550

* Mobilization in all five districts of Kamashi Zone and Oda District in Assosa Zone were not conducted due to security reasons, but posters were placed throughout these target areas.

3.2 MOBILIZATION CONCURRENT WITH SPRAY

A day before spray in each Kebele, mobilizers collaborated with Kebele leaders to make announcements and to sensitize homeowners about the spray scheduled for their Kebele. This notice was to ensure homeowners would properly prepare their homes for the spraying and would be available to meet the spray team.

Figure 3: On the left, SQL transferring key messages on importance of house preparation to householders and on the right, a well-prepared house ready for spraying



On the actual day of spraying, the mobilizers ensured that they linked spray operations teams to targeted communities. Mobilizers also helped household owners to prepare their structures for spraying, encouraged homeowners to accept IRS, and be ready for the spray. Once the spray team arrived, they directed the SOPs to the mobilized structures. This ensured that the spray teams conducted spraying in well-prepared homes and ensured efficiency of operations.

3.3 COMMUNITY MEETINGS AND DIALOGUE

During the 2019 IRS campaign, the VectorLink Ethiopia team ensured that community leaders and their communities were involved early in the campaign. Zonal IRS coordinators arranged community meetings in the various kebeles through HEWs. To improve IRS acceptance at the Kebele level, Kebele administrators or their representatives were engaged in meetings about four weeks before the start of the campaign.

4. IMPLEMENTATION OF IRS ACTIVITIES

The implementation of IRS was carried out in close collaboration with the FMOH, the three RHBs, and zonal and district health offices. Using a district-based IRS model, the VectorLink Ethiopia project provided the technical oversight, which included training, logistics, supervision, and M&E in all 44 PMI-supported districts, but the DHOs assigned their staff to serve as supervisors, district IRS MFPs, TLs, and some SQLs. DHOs also recruited the seasonal spray personnel (SOPs, porters, DECAs, washers, water fetchers, security guards) based on recruitment criteria developed by VectorLink Ethiopia in partnership with the three RHBs. The number of spray teams was determined based on the number of targeted structures per district.

The 2019 IRS campaign took place from May 20 to July 22, 2019. IRS implementation start dates were staggered so as to allow early spraying in Gambela Region and West Guji Zone districts that usually become inaccessible during the rainy season. Staggering also allowed project staff to supervise fewer districts at a time. The spray campaign took place over 9–34 operational days in Benishangul-Gumuz, 13–20 operational days in Gambela, and 27–30 operational days in Oromia. Annex C shows campaign start and end dates for each district. Despite a delayed start in 11 out of 20 districts in Benishangul-Gumuz, mainly because of security concerns, Metekel and Kamashi zones completed IRS within 30 operational days. The last four districts started 35 days later than planned, and the campaign was completed 18 days later than planned.

Spray operations ran six days per week with one rest day, typically corresponding to the local market day. The project designed the spray calendar so that spray teams sprayed remote and hard-to-reach kebeles at the start of the campaign, to ensure those communities were reached early in case rain later made the roads later inaccessible.

Based on the dispersion of the targeted kebeles, all districts had at least one operations site: 14 districts had one operations site, 27 districts had two operations sites, and the rest had more than two operations sites. Forty-four out of 78 operational sites had a permanent storeroom, wash area, and fixed soak pit; the rest had a temporary warehouse at a local health post or health center. The spray teams were dispatched from the sites every morning at around 7:30 am and returned after completing their daily duties, around 3:30 pm. At least two vehicles per district were used to transport spray teams between their operations site and spray sites. Supervisors usually accompanied the spray teams for the whole day but sometimes traveled separately and visited multiple teams, based on vehicle availability. Upon returning to the operations site, the SOPs turned in any unused insecticide and empty bottles to the SQLs, cleaned their spray pumps using the progressive rinsing technique, and returned their PPE and spray pumps to the storekeepers. SQLs also returned the insecticides to the storekeepers and handed over their data forms to the MFPs, who checked them for quality and submitted them to the DECAs at the district level.

In 2019, VectorLink Ethiopia piloted 15 Goizper pumps in Waliso district. During the training of trainers (TOT), supervisors were oriented on the parts and use of the Goizper pumps. The supervisors later trained SOPs and SQLs on the use of the Goizper pumps in Waliso District in West Shoa Zone (Oromia). The SOPs reported that these pumps were lightweight, had increased visibility, and had a pressure gauge and backpack straps that made them much easier to use than the Hudson pumps. The supervisors also observed that the discharge from Goizper pumps was more uniform than that from Hudson pumps.

4.1 IRS SUPERVISION

The VectorLink Ethiopia team developed and used an enhanced monitoring and supervision schedule during the 2019 spray campaign. The schedule showed the role of specific individuals, which site they were working from, the type of supervisory tools to be used, and the targeted frequency of usage of each supervisory tool. The project deployed 14 full time staff (nine zonal IRS coordinators and five senior staff) to the zones during IRS implementation to provide supportive supervision. Each VectorLink zonal IRS coordinator was in charge of 3–5 districts and worked closely with regional, zonal, and district MFPs. The project also recruited 29 seasonal district IRS supervisors for the 34 PMI targeted districts in the Benishangul-Gumuz and Gambela regions. Five of the seasonal district IRS supervisors who worked in Gambela Region were re-deployed to Benishangul-Gumuz after completing their duties in Gambela. Zonal IRS coordinators and seasonal district IRS supervisors provided support in districts during the IRS cascade training and IRS implementation. They also ensured that there was capacity building of the district staff and spray quality in the districts. IRS supervision was conducted in collaboration with the RHBs based on the supervision plan. At the national level, the chief of party (COP), the deputy COP and the two operations managers provided continuous oversight in the three regions. Each region had a designated responsible member of the senior management team who had the authority to make immediate decisions in the field. The COP and the one operations manager shared this authority for Gambela because of the complexity of the region. The second operations manager was in charge of Benishangul-Gumuz, and the Deputy COP was in charge of Oromia.

Two members of the PMI VectorLink Project's home office team, Technical Program Manager Cecilia Flatley and Director of Vector Control Allan Were, traveled to Ethiopia to provide short-term technical assistance (STTA) during the campaign.

Apart from the senior management supervisors, the M&E manager and the database manager from the VectorLink team also joined the district teams for supervision. All teams used standardized VectorLink supervision and monitoring tools, which were loaded on mobile phones, to assess the spray quality, environmental compliance activities, and spray data collection. The project provided one mobile phone for each of the supervisors for supervision purposes.

During supervision, the SQLs and other supervisors were tasked with using the Directly Observed Spraying (DOS) forms to monitor quality of spraying and provide on-the-spot feedback to improve SOP performance. During the spray season, SQLs and TLs used the DOS checklist and conducted a total of 16,608 direct supervisions out of 33,001 planned DOS checklists throughout the campaign.

During the 2019 IRS campaign, the supervision was conducted to the expected PMI VectorLink standard in all the 44 PMI targeted districts. Overall, the project showed significant improvements in enforcing compliance with PPE, homeowner preparation, wash area processes, and store management compared with the 2018 IRS campaign. SOPs were well trained and generally maintained the appropriate distance, swath width, swath overlap, and speed in their application. However, inadequate household preparation was observed in three districts in Southwest Shoa Zone in Oromia Region. As a result, the campaign was interrupted for one day in the three districts and all the spray teams were re-trained. More broadly, the interruption aimed to send a strong message to the teams about the zero-tolerance for poor household preparation. Supervision was subsequently strengthened to enforce this no-tolerance policy. The COP, Deputy COP, and the project's director of vector control returned to these districts and confirmed that the issue had been resolved.

Figure 4: Signs of good household preparation: Personal items stored outdoors and completely empty structures



4.2 LOGISTICS AND INVENTORY CONTROL

In 2019, the VectorLink Ethiopia team modified the vehicle procurement approach to ensure vehicles of the highest quality were hired for the IRS campaign. A total of 145 vehicles were contracted: 57 of them were buses and 88 were long-based 4X4 vehicles. During IRS implementation, all the vehicles were dispatched on time, immediately after being inspected by the VectorLink team. The spray teams reported that they were satisfied with the safer, more comfortable travel arrangements. The VectorLink Ethiopia team also developed a documentation system by which vehicles and drivers could be easily identified as having passed the inspection and/or training, respectively, guaranteeing that the vehicles and drivers would not be changed by the vendors after passing the inspection.

The logistics coordinator was in charge of managing stock at the central level and supervising the 88 storekeepers. Each district store was managed by two storekeepers, one government employee, and one assistant storekeeper whom VectorLink Ethiopia hired as a seasonal worker. All of the districts had storerooms where all of the commodities were stored according to the standard PMI Best Management Practices (BMPs), meaning the insecticide and insecticide-contaminated items were stored separately from the clean commodities. To enhance tracking of insecticide use, the project provided IRS stock cards, bin cards, incoming and outgoing registration books, and insecticide tracking forms to account for the quantity issued, quantity used, and quantity returned on a daily basis (Annex D).

With the old stock of 97,467 bottles of Actellic 300CS insecticide, which was expiring in February 2020, it was important for all the storekeepers to adhere to the 'first to expire first out' (FEFO) principle to ensure the supply of old Actellic would be exhausted. To facilitate this, all districts were allocated with only 85% of the estimated insecticide need to make sure that districts did not have excess insecticide that could not be used. The remaining 15% for all the districts was stored at the regional central warehouse for relatively easy access. The project allocated one vehicle per region specifically for transportation of insecticides within the districts.

For the entirety of the campaign, the logistics coordinator received daily text messages from the district storekeepers on the consumption of the insecticides and submitted a weekly insecticide consumption report to the COP. When a district had less than three days' worth of insecticide in stock, the zonal IRS coordinator would dispatch an additional quantity to that district, calculated based on the actual consumption rate. If a district was found to be consuming less insecticide than expected, the district management team would analyze the consumption rate and prepare to allocate any excess insecticide to another district to ensure the total exhaustion of old insecticide before using any new insecticide.

As part of supervision, the senior VectorLink team also conducted physical inventory control in all the storerooms to ensure that all the old stock was used before any new stock. In the store where the old

and new stocks were mixed, the team ensured that the old stock of Actellic was marked with highly visible paint so that it would be visually distinct from any new supply that was procured in 2019.

4.3 IRS CAMPAIGN RESULTS

VectorLink Ethiopia planned to target 542,148 structures, but the target was adjusted to 509,594 over the course of the 2019 campaign due to security issues prohibiting teams from reaching certain areas. The SOPs sprayed 487,746 structures out of 510,449 structures found, a spray coverage of 95.5%. The campaign protected 1,334,868 people, including 33,245 (2.5%) pregnant women and 228,262 (17.1%) children under the age of 5. Table 7 shows regional-level performance. Annex C indicates campaign start and end dates for each district; Annex E shows spray progress and coverage data by district and by region.

Table 7: Regional Spray Progress and Coverage

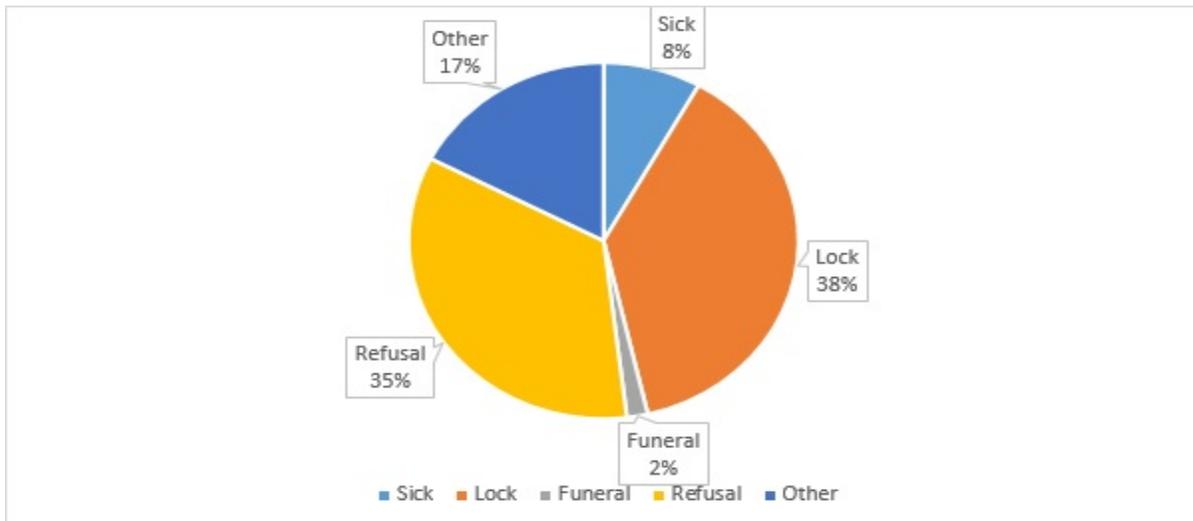
Province	Original Targeted	Adjusted Targeted*	Found	Sprayed	Spray Progress**	Spray Coverage
Benishangul-Gumuz	282,484	256,603	255,073	242,839	95%	95%
Gambela	120,493	113,820	111,746	107,173	94%	96%
Oromia	139,171	139,171	143,630	137,734	99%	96%
Total	542,148	509,594	510,449	487,746	96%	96%

* The excluded kebeles are listed in Table 9 in the next subsection.

** Spray progress is calculated using the adjusted target.

As noted above and illustrated in Figure 5, the 2019 spray campaign did not spray 22,703 structures (4.4% of total structures found). The reasons for not spraying were: structures were locked (38%), refusals (35%), sick person in the structure (8%), funerals (2%), and “other” reasons (17%). In 2018, refusals had accounted for 39% of the reasons for structures not being sprayed, and locked structures accounted for 41%.

Figure 5: Reasons for unsprayed structures



4.4 SECURITY

Ethiopia experienced episodes of ethnic conflict within and between regions leading up to and during the IRS campaign period. Campaign preparations and implementation were affected by unrest between Oromia and Benishangul-Gumuz regions, between Gambela and Oromia, and within each of the three regions. The project worked with the Abt's Global Security Office to conduct a Security Risk Assessment for the VectorLink Ethiopia project. The director of the Global Security Office travelled to Ethiopia to provide STTA, during which he reviewed the program's overall security situation. He provided staff and driver security training, travel tracking procedures, and other security management methods. The STTA enabled the VectorLink country team to make sound decisions regarding security issues.

All 20 districts of Benishangul-Gumuz Region were supposed to start operations on June 3, 2019, but only nine were stable enough to start on time. IRS operations for seven districts in Metekel Zone and four districts in Kamashi Zone started on June 17 and July 8, 2019 respectively. In Kamashi Zone, the project found a significant number of structures which were vacated or demolished due to internal conflict in the area. As a result the target number of eligible structures was reduced as shown in Table 8.

Despite the volatile security condition that the country experienced before and during the IRS campaign, the project managed to complete spraying with no serious security incidents. In Gelana District, 19 SOPs and three SQLs had a negative encounter with soldiers who wanted to use their vehicle to transport a wounded soldier. When 10 people were killed and 20 more injured in Mandura District on June 25, VectorLink Ethiopia immediately ceased IRS operations in the district, with the support of PMI, the Benishangul-Gumuz RHB and Mandura DHO. Security threats also forced it to cease operations in select kebeles in other districts to a full or partial extent.

During the conflict, the VectorLink team developed a good relationship with local authorities, who included the local political leadership and security authorities. This made it possible for the project to get information on a daily basis regarding the conflict, which enabled the team to make informed security decisions, in particular on where spray teams could and could not go.

Table 8 shows the number of kebeles that were partially or complete excluded from the IRS operations.

Table 8: Kebeles that were affected by Security

Region	Zone	District	# of Kebeles Partially Excluded from Spray	# of Kebeles Fully Excluded from Spray	Number of Structures Excluded
Benishangul-Gumuz	Kamashi	Belojegenfof	10	2	3,885
		Agalo Meti	14	0	2,436
		Kamashi	11	2	2,038
		Yaso	10	0	3,522
	Metekel	Dangure	0	7	1,892
		Guba	0	2	394
		Mandura	0	12	10,519
Oromia	West Guji	Gelana	3	0	468

4.5 MOBILE PAYMENT OF SEASONAL WORKERS

For the first time, in 2019, VectorLink Ethiopia used electronic mobile payment to pay all seasonal staff, including government supervisors and mobilizers. Payment was made via Commercial Bank of Ethiopia Bulky Mobile Money transfer. The Bulky Mobile Money payment system is a convenient, simple, and secure way to make multiple payments. It enabled VectorLink Ethiopia to send wages to the many seasonal workers who were widely dispersed and had limited access to banks. It is also more secure and cost effective than previous cash management services: VectorLink Ethiopia team members did not have to travel with cash to the areas of disbursement, and the program did not need to cover their per diem, fuel, and other costs. The bank sent the payments to the phone numbers the IRS workers had provided. After each payment, the bank generated a system report as proof of payment; it also showed unsuccessful transmissions that required a repayment to be sent.

Despite its advantages, use of mobile payment still presented challenges: cash-outs were sometimes difficult, as most districts are remote and rural and do not have banks or agents to pay the seasonal workers. In these cases, the Vectorlink team had to make arrangements with the CBE to send officers to make the payments in those districts. These challenges were compounded by severe interruptions of the mobile phone system during the campaign, which were as a result of the government shutting down the internet during national exams and the coup in Amhara Regional State. Combined, this resulted in the failure to transmit the payment confirmation messages to the payees on time and led to delayed payments. In the future, contracts with seasonal workers and vendor will account for these issues and state an extended deadline for receiving payment after services rendered to better manage expectations up front.

5. ENTOMOLOGICAL MONITORING

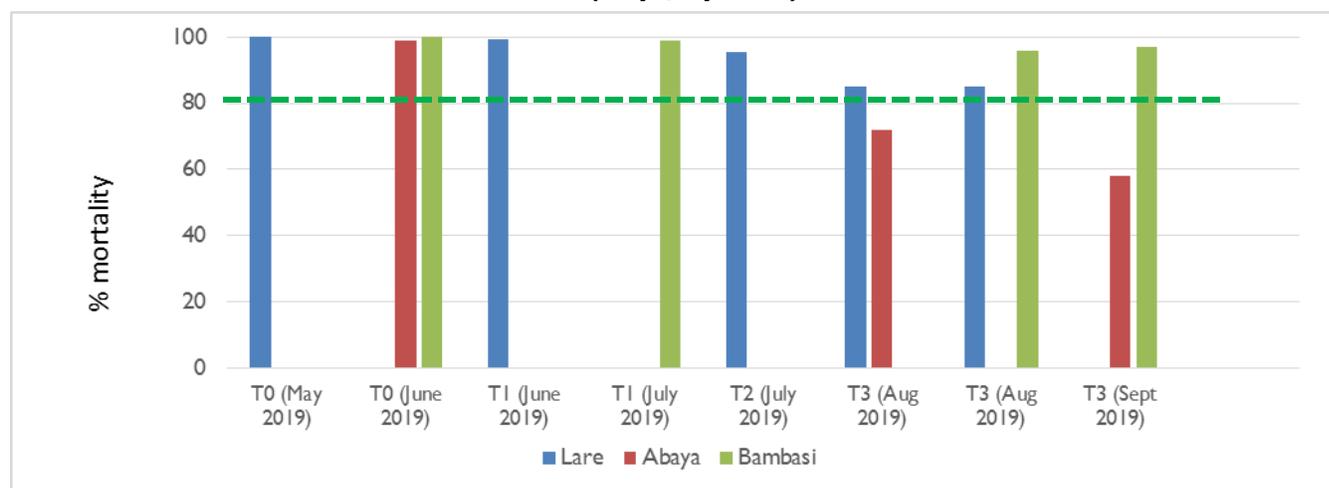
VectorLink Ethiopia supports the NMCP in conducting routine entomological surveillance and generating data on key entomological indicators through longitudinal monitoring of malaria vector behavior in seven districts, cross sectional surveys in 11 districts and routine surveillance on *An. stephensi* in four districts, and insecticide resistance monitoring in 26 sites. These data guide the NMCP and VectorLink Ethiopia on vector control decision making, including insecticide selection, IRS programming, and insecticide resistance management. The project also conducts bioassays to assess the quality of spray during the IRS campaign, and additional bioassays on a monthly basis thereafter to measure the residual life of Actellic 300CS on walls.

This section describes the IRS quality assessment conducted during the 2019 spray campaign period. All other entomological monitoring results are provided in a standalone report.

To assess spray quality, VectorLink Ethiopia conducted World Health Organization (WHO) cone bioassays in three PMI-supported IRS districts: Lare in Gambela, Bambasi in Benishangul-Gumuz, and Abaya in Oromia. Figure 5 illustrates the results.

The VectorLink Ethiopia team conducted the cone bioassays in 12 selected sprayed houses in each district (total 36 houses), 24–48 hours after IRS. The wall surfaces of the houses in Lare were mud; in Bambasi and Abaya, the surfaces were paint and mud. The test mosquitoes were susceptible insectary *An. arabiensis*. The first cone bioassays (T0) were conducted in May in Lare, and in June in Abaya and Bambasi. The results at T0 showed 100% mosquito mortality in Lare and Bambasi and 99% mortality in Abaya. At one month after IRS (T1), mortality rates in Lare and Bambasi were 99.5% and 98.9%, respectively. Because of security concerns, bioassays were not done in Abaya at T1. After two months (T2), 95.4% *An. arabiensis* mortality was scored in Lare, 96% in Bambasi and 71.9% in Abaya. At T3 (3 months after spraying) 85%, 96% and 58% of mosquitoes were killed in Lare, Bambasi and Abaya, respectively. All control mortality was below the 5% threshold and therefore corrected mortality was not necessary.

Figure 6: Mortality of insectary *An. arabiensis* in WHO cone bioassays in Lare, Abaya, and Bambasi (May–July 2019)



NB: The green dotted line indicates of the minimum mosquito mortality threshold for the determination of the decay rate of Actellic 300CS (80%).

6. MONITORING AND EVALUATION

The M&E approach of the 2019 IRS campaign successfully incorporated lessons learned from the 2018 IRS campaign and best practices from other PMI VectorLink countries. Additionally, VectorLink Ethiopia in collaboration with the Gambela RHB successfully conducted structure enumeration in Gambela Region.

6.1 KEY OBJECTIVES

In 2019, the VectorLink Ethiopia M&E team focused on improving the data quality, data collection, and reporting system through:

- Emphasizing accuracy of both data collection and the data entry process through comprehensive trainings and supervision at all levels;
- Streamlining and standardizing data flow to minimize errors and facilitate timely reporting; and
- Ensuring IRS data security and storage for future reference through establishment and enforcement of proper protocols

6.2 DATA COLLECTION

Data was collected using standardized data collections forms designed to capture all core PMI indicators (Annex F shows all the performance indicators with annual targets and results).

Of the six data collection forms currently being used, the Daily Spray Operator form is the primary data source for data entry, analysis, and reporting. SQLs use the Daily Spray Operator form to collect the daily spray data from households and report on the project's primary indicators. The remaining data collection forms are used during training or for supervision purposes during the IRS campaign. In addition, VectorLink Ethiopia uses numbered IRS cards; these are distributed to households after spraying, and they give each household a unique identification number to use as a spray record.

VectorLink Ethiopia reviewed the existing M&E system and made appropriate modifications before implementing IRS to ensure the collection, management, and reporting of high-quality data, including translating all forms into local languages. The team also prepared job aids for mobilizers and SQLs by reviewing different scenarios, which helped in appropriate distribution of IRS cards during mobilization and operation. MFPs and supervisors demonstrated a good understanding of the forms and IRS cards and were able to explain the forms in detail during the cascade training for SOPs, porters, and SQLs.

In the 2019 spray season, VectorLink Ethiopia piloted an approach in Ilu District, Oromia in which SOPs collected IRS data in addition to spraying. All prospective SOPs fulfilled the minimum educational criteria (i.e., 10th grade and above). VectorLink provided a two-day M&E training to ensure all the SOPs understood the tools and were able to record IRS data from households.

The following were key findings from the pilot:

- There was no difference in quality between the data collected by SOPs and the ones collected by SQLs.
- The number of structures sprayed per day by SOPs collecting data on their own was not significantly different compared to the number sprayed by SOPs whose data was collected by SQLs.

- SQLs had more time to conduct the direct observation of spraying.
- There was a reduction in number of SQLs and consequently a reduction in the cost per structure.

6.3 DIMAGI PLATFORM

VectorLink Ethiopia collaborated with Dimagi to ensure quality reporting and supervision in all target districts.

The Dimagi platform included:

Mobile-based Performance Monitoring Tracker (PMT) – Daily SMS of four essential spray progress indicators sent by the MFPs.

Smartphone-based Spray Supervision System –Five spray operations checklists are loaded on to a smartphone and completed in the field by supervisors.

Bulk SMS Job Aids – An automated SMS system was used to remind spray staff (e.g., team leaders, MFPs) of specific guidelines and/or to communicate problems or challenges noted during the spray campaign.

Data Collection Verification Form – A data quality assurance tool to identify data inconsistencies in real time.

6.4 DATA QUALITY ASSURANCE PROTOCOLS

To ensure data integrity, PMI VectorLink Ethiopia used a standardized approach to data collection by providing standard tools and required training for all the data collectors and supervisors at each level. One of the key tools for providing corrections in the field was the Data Collection Verification form.

The DCV tool is a data quality assurance tool that is used to check the accuracy of data collected in the field to ensure that the data written on the SOP form matches the information reported by households. Ethiopia hired M&E assistants in all districts whose main responsibility was to conduct routine data collection verification, which helped identify gaps, especially locating structures that were not sprayed/visited by the spray team. Based on the lessons learned in 2018, the M&E team used DCV data that were collected by M&E assistants to provide feedback to districts on coverage, highlighting areas that had not achieved 85% spray coverage. The report also specified structures to be revisited through mop-ups to attain 85% coverage. The most common issues found through the use of the form are summarized in Table 9.

Table 9: Use of Data Collection Verification Form: Common Issues and Corrective Actions

Errors/Issues Observed	Corrective Actions Taken
M&E assistants found spray coverage below 85% in 62 kebeles across all the 44 PMI-supported districts.	The VectorLink supervisors, with support from the DHO management team, ensured revisits in all the 62 kebeles.
DCV assessments by VectorLink supervisors and M&E assistants found incomplete information on IRS cards (i.e., structure number, population size, etc.) and also gaps in marking structures.	VectorLink and DHO supervisors carried out focused re-trainings for SQLs who were not recording information appropriately.
Multiple IRS cards were found in a single household.	The supervisory team met with mobilizers and SQLs and gave orientation on IRS card distribution approaches. The team also discussed how to convince households to look for IRS cards that were previously received by the household and found in the house.

6.5 DATA ENTRY

VectorLink Ethiopia used the VectorLink Microsoft Access Database Cleaning/Reporting Tool to ensure high-quality data. VectorLink Ethiopia employed 45 DEC's for data entry/cleaning purposes. Data entry was carried out at two levels, first by entering "totals" (for quick reporting and feedback) then by "details," i.e., by each structure captured on the Daily Spray Operator form, for more accurate data entry and verification. For quality control and timely generation of the weekly spray progress reports for PMI, all data were expected to be entered and synced within 48 hours of spraying. In some instances, this did not happen, due to intermittent or weak internet connectivity as a result of nationwide blockage of internet service.

6.6 DATA STORAGE AND CLEANING

Hard copies of the Daily Spray Operator forms are stored in binders at the district level. The forms are filed by date and team.

At the end of every day, all data were backed up electronically in three stages, first in a back-up folder on the data entry laptop, then to a cloud back-up system (Dropbox), and then on an external memory drive that was provided to each DEC.

The DEC's cleaned spray data daily throughout the spray campaign, under the supervision of the M&E manager, M&E coordinator, and Database manager, with final data cleaning completed eight days after the end of the spray campaign. SQLs collected the data and verified the SOP forms while TLs checked and verified data. Further checks were completed by M&E assistants, MFPs, and district IEC officers. District DEC's checked the completeness and accuracy of daily spray data variables before entering the data into the database.

7. ENVIRONMENTAL COMPLIANCE

This section focuses on the activities that were undertaken in overseeing the 2019 IRS program compliance with:

- The U.S. Government: USAID Regulation 216
- The 2015 Supplementary Environmental Assessment (SEA) and the 2019 Letter Report
- This section also presents operational issues that arose during IRS implementation and how the team responded. More details can be found in Annex G, the Environmental Mitigation and Monitoring Report.

Under the umbrella of the 2015-2020 SEA, a Letter Report was prepared for the 2019 spray operations and approved before spraying commenced. Similar to 2018, VectorLink Ethiopia used the brand-name Actellic 300CS, an organophosphate (pirimiphos-methyl), in all 44 PMI-supported districts. As discussed above, civil unrest presented a security concern and delayed the start of 2019 IRS operations in some districts. Despite the late start and slowed progress, VectorLink Ethiopia's strong monitoring system ensured that IRS operations adhered to PMI BMP environmental compliance requirements to protect spray actors, beneficiaries, and the environment. Activities performed are discussed below.

7.1 PRE-SEASON ENVIRONMENTAL COMPLIANCE ASSESSMENT

VectorLink Ethiopia conducted a Pre-Season Environmental Compliance Assessment (PSECA) several weeks before spray operations were scheduled to start, to ensure that operations sites are in accordance with Ethiopia environmental regulations, as well as supplemental World Health Organization standards.

To do the PSECA, the VectorLink Ethiopia team travelled to all 78 IRS operations sites in the 44 target districts, to check the readiness of IRS facilities, such as warehouse capacity to store and handle insecticides and other IRS supplies, soak pits, wash areas for IRS equipment, adequacy of workers' washrooms, showers, and toilets, pit latrines, and so forth.

The team supervisors used a smartphone application to do the assessment. Subsequently, work lists detailing any environmental compliance deficiency were generated for each operations site, and implementation plans were prepared to fix the deficiencies. As recommended in the 2019 work plan, the project converted 64 temporary wash areas into cemented ones to avoid rebuilding the wash areas every year. Sixteen wash bays in Kamashi and Assosa zones could not be converted because of security concerns.

During the 2019 spray season, VectorLink Ethiopia planned to implement IRS in Akobo District of Gambela Region. To do this, the team needed to transport insecticides across the Akobo River. Transporting insecticides across water poses substantial risk to the environment, and to the health and safety of nearby human and animal populations. Therefore, to ensure safe transport of insecticides across the Akobo, VectorLink Ethiopia in close collaboration with the Director of Environmental Compliance and Safety implemented environmental compliance guidelines stipulated in the PMI BMPs with regard to water crossings. The team evaluated all possible crossing points in terms of the distance, time required, and type of boat, as well as the speed and turbulence of the water at the crossing. After being satisfied that the team had implemented all safety measures, the COP, in consultation with the Director of Environmental Compliance and Safety, authorized the crossing.

Before the second round of PSECA was conducted, the project also ensured that the stores in all 44 PMI target districts were equipped with fire extinguishers, pallets, first aid kits, dust bins, emergency spill kits, and thermometers.

7.2 FOLLOW-UP ENVIRONMENTAL COMPLIANCE INSPECTIONS

A week before the spray campaign began, the ECO and VectorLink zonal IRS coordinators revisited all IRS operations sites to confirm that the refurbishments were completed and that the sites were ready for the 2019 IRS campaign. All storage facilities in PMI-target districts met the minimum environmental compliance requirements and were certified to receive and safely store pesticides. Additionally, all soak pits were suitable for an environmentally responsible disposal of pesticide-contaminated liquid waste.

7.3 PRE-CONTRACT MOTOR VEHICLE INSPECTIONS AND DRIVERS TRAINING

All the hired vehicles were equipped with Spill Management and First Aid Kits, Material Safety Data Sheets, and Accident/Emergency Response Procedures in accordance with BMP guidelines. The team also provided training for 145 hired drivers of the hired vehicles; the drivers received documentation of having taken the training that could be verified by supervisors in the field.

7.4 MEDICAL CLEARANCES

As part of protecting the spray actors from any incident related to the spray operations, all spray actors hired for the 2019 spray season underwent medical examinations to determine their physical fitness for the program's demands. All female spray actors were given pregnancy tests to ensure no expectant mothers were at risk of exposure to insecticide. The test was repeated 30 days later for all districts that sprayed for more than 30 days. No positive pregnancy test was recorded during the 2019 IRS campaign.

7.5 TRAINING OF CLINICIANS IN MANAGEMENT OF INSECTICIDE POISONING

VectorLink Ethiopia conducted a one-day training on insecticide exposure management for 79 clinical practitioners from 44 PMI target districts. These clinicians were made responsible for orienting other clinicians in their health facility on the management of insecticide exposure cases. The project also ensured that the antidote for organophosphate poisoning was available at all health facilities closest to the IRS sites in districts that would be sprayed in 2019. No project funds were used to procure the antidotes.

7.6 MID-SPRAY ENVIRONMENTAL COMPLIANCE INSPECTIONS

To reinforce compliance with environmental guidelines, VectorLink Ethiopia staff, in collaboration with government supervisors, conducted monitoring and supervision using monitoring and supervisory checklists embedded on smartphones. During the 2019 IRS campaign, the team completed 7,320 supervision and monitoring checklists. The main observation reported was that some field staff were filling out the checklists incorrectly due to language barriers. , , Out of 3,647 red flags recorded, only 109 were as actual problems. These issues were minor incidents like incomplete house preparation and incomplete PPE during morning mobilization.. As soon as supervisors reported them, VectorLink Ethiopia took corrective action, especially re-training on homeowner preparation during morning mobilization. This drastically reduced the instances of non-compliance. Table 10 shows the numbers of completed supervision checklists.

Table 10: Number of Completed Supervision Checklists

Supervision Checklist	Target	Frequency Done	Red Flag Reported	True Red Flags
Morning mobilization	2,388	1,116	470	5
Homeowner preparation	13,485	4,956	2,530	87
End-of-day clean-up	2,388	824	283	9
Storekeeper performance	1,191	430	364	8
Total	19,452	7,326	3,647	109

7.6.1 ENVIRONMENTAL COMPLIANCE AUDIT

Environmental Compliance Operations Support (ECOS) conducted an IRS Environmental Compliance Field Evaluation as mandated by PMI. The ECOS auditor, accompanied by the VectorLink Ethiopia deputy COP and the ECO, went to four districts (Gambela Town, Gambela Zuria, Bambasi, and Menge) to assess environmental compliance at operations sites. VectorLink Ethiopia supported the assessment, and the minor areas for improvement observed by the auditor were immediately communicated to the teams.

7.6.2 MORNING MOBILIZATION, HOMEOWNER PREPARATIONS AND SOP PERFORMANCE

VectorLink Ethiopia ensured that during the 2019 IRS campaign, the morning mobilization was an integral aspect of the spray campaign. As part of morning mobilization, SOPs first reported to a restaurant to have their morning meal. After breakfast, the teams demonstrated any aspect of IRS operations that was noted to be a challenge during the previous day or within the week. To ensure SOP and beneficiary safety, the IRS supervisors inspected all SOPs to identify any symptoms of illness such as difficulty breathing, fatigue, weakness, or dizziness. As a result of this routine activity, VectorLink Ethiopia experienced minimal red flags during the 2019 IRS campaign.

7.6.3 STOREKEEPER PERFORMANCE INSPECTIONS

In 2019, VectorLink Ethiopia fully sponsored 44 seasonal storekeeper assistants who worked closely with DHO storekeepers, which brought the total number of storekeepers to 88. Because most of the storekeepers had worked for the previous IRS campaign, they were accustomed to adhering to PMI BMP guidelines. Additionally, PMI VectorLink staff monitoring and supervising IRS operations were able to identify and immediately rectify a number of compliance issues. Most minor discrepancies observed in stock management occurred in the first week of spraying and were addressed by conducting a physical count of the stock until the number of empty and full bottles matched the opening stock. As the IRS campaign progressed, the storekeepers improved their performance and, by the end of the campaign, no compliance issues were recorded.

7.6.4 END-OF-DAY CLEAN-UP INSPECTIONS

These inspections were conducted at the IRS operational sites. The 2019 IRS campaign witnessed a drastic reduction in compliance issues compared with 2018 spray season. This was attributed to the daily review of correct end-of-day clean-up protocols with SOPs during morning mobilization.

7.7 INCIDENTS

The project reported only one incident to PMI during the 2019 spray campaign, in accordance with incident report requirements and summarized in Table 11.

Table 11: Environmental Incidents Reported during the 2018 IRS Campaign

Date	Type	Description
March 13, 2019	Dog bite	An enumerator who was collecting data in Gog District was bitten by a dog. She was treated for the minor wounds and given an anti-rabies treatment.
May 25, 2019	Store robbery	Dangure storeroom was broken into and some IRS commodities were stolen.
May 28, 2019	Negative encounter with soldiers	In Gelana district, 19 SOPs and three SQLs were detained by soldiers who wanted to use their vehicle to transport a wounded soldier.
August 5, 2019	Car accident	A team of two people consisting of a driver and entomology technician were involved in a car accident in Bambasi district.

7.8 POST-SEASON ENVIRONMENTAL ASSESSMENT

VectorLink Ethiopia conducted the Post-Season Environmental Assessment across all the 44 PMI target district between August 10 and 30, 2019. The assessment confirmed that all IRS items, including insecticides and IRS waste, were collected from the operations sites and returned to the central warehouse. It also confirmed that all the soak pits and their surroundings areas had been cleaned and cleared of any waste and IRS items. Soak pits were secured with locks and the wash areas covered with plastic sheets to protect them from vandalism as well as contamination by humans and animals. Moreover, IRS commodity records were updated and balanced before closing the store rooms.

7.8.1 SOLID WASTE DISPOSAL

The project is in the process of collecting contaminated waste from district stores for transport to the central warehouse in Addis Ababa and eventual disposition of all items. VectorLink Ethiopia project signed a memorandum of understanding with Tewodros Fikru rubber and plastic production factory to recycle empty bottles into electrical conduit cables. Preparations for the incineration of used masks and other contaminated waste were completed and the process only awaits transport of the waste from the districts. The solid waste disposal methods are summarized in Table 12.

Table 12: Summary of Type, Quantity, and Disposal Stream of 2019 IRS Solid Waste

Waste Category	Quantity	Disposal Method
Empty bottles	121,768 bottles	Will be recycled into electric cable transferring conduits.
Plastic sheeting	40 Kg	Will be re-used to cover the soak pits during the off-season and then disposed of together with the used bottles for conduit production.
Boots	120 Kg	Worn-out boots will be given to SOPs in need after the boots are decontaminated.
PVC gloves	131 Kg	Will be given to deserving workers after the gloves are cleaned with soap and water.
Used nose masks	3590 Kg	Will be incinerated at the central warehouse in Addis Ababa-Burayu.
Worn-out overalls and insecticide bags	600 Kg	Will be given to deserving SOPs after the items are thoroughly cleaned with soap and water.
Cardboard boxes	5074 Kg	Will be recycled into insecticide packaging material in a government-owned pulp and paper production factory.

7.8.2 LIQUID WASTE DISPOSAL

During the campaign, liquid effluent from the rinsing of pumps was reused as water for mixing insecticide the next day. Water that was used to wash the outside of the spray tank and rinse the strainer and nozzles was drained into soak pits according to the PMI BMP Manual. The soak pits' charcoal layer absorbs traces of pesticides in rinse water and holds them until they degrade.

8. GENDER MAINSTREAMING

The PMI VectorLink Project views gender equality and female empowerment as development goals in their own right, and it measures progress toward these goals in terms of women's participation in its vector control activity. To achieve these goals, VectorLink Ethiopia works closely with RHBs' gender advocates to implement policies that promote the hiring of female seasonal workers and ensure a safe and respectful workplace for all. In 2019, the project's gender focal person coordinated the development of an operational plan for gender mainstreaming activities.

VectorLink Ethiopia included a gender integration module in all capacity-building workshops, including TOT sessions. By collaborating with regional gender officers and district-level women's affair officers, the project staff followed up on and advocated for the inclusion of women across the project's operations and throughout the projects' districts. The project enhanced advocacy at the regional, zonal, district, and community levels to increase the percentage of women recruited at all levels, especially in decision-making positions within the project. For the 2019 spray campaign, VectorLink Ethiopia targeted a minimum of 35% women's recruitment except for district-level supervisors, whom the project does not directly recruit.

VectorLink Ethiopia also used recruitment adverts that depicted women participating in a wide range of IRS activities and stated explicitly in hiring materials that women are strongly encouraged to apply. Given some concerns about privacy during the 2018 IRS campaign, the program reinforced the importance of all bathrooms having adequate privacy in the 2019 spray season. The project also procured sanitary napkins to reduce this barrier to women's participation in IRS.

Additional strategies included:

- The project identified at least two women in each district who had previously worked for the project and who were able to move into SQL (supervisory) roles this year with targeted mentorship to support their transition and ensured that their replacements were also women.
- The team procured female-size IRS commodities, such as coveralls and boots, which made the women more comfortable.
- The team reviewed training and mobilization documents to include more pictures of women in varied roles and explicitly stated the project's intention to fill all roles with qualified women whenever possible.
- The project procured SIM cards for both men and women who were interested in working for VectorLink but would not have been able to if they couldn't receive mobile payments. This encouraged women's participation.
- The team identified veteran female community mobilizers to promote women's participation. This was done during house-to-house mobilization.
- The project ensured that there were separate accommodations for women at campsites.
- The project implemented the sexual harassment policy for all employees, including seasonal workers, to promote a respectful work environment. Posters of harassment were posted at all the IRS operations sites. See Figure 7.

Figure 7: PMI VectorLink Ethiopia poster on anti-sexual harassment



Despite all the strategies to increase women’s participation in IRS, women represented just over a quarter (27.9%) of seasonal staff in the 2019 IRS campaign (Table 13). The 1,337 women it hired supported IRS in many different roles: TLs, SQLs, SOPs, porters, washers, water fetchers, storekeepers, and mobilizers. The 27.9% was a drop from 35.0% in 2018, and the percentage of women hired as SOPs fell from about 6.0% in 2018 to 3.6% in 2019.

Table 13: Female Engagement in IRS Implementation by Region

Region	Male	Female*	Total	% Female
Benishangul-Gumuz	1,496	683	2,179	31.3%
Gambela	1,076	386	1,462	26.4%
Oromia	875	268	1,143	23.4
Total	3,447	1,337	4,784	27.9%

* The breakdown of female seasonal staff is as follows: 3 TLs, 87 SQLs, 49 SOPs, 175 porters, 108 washers, 40 water fetchers, 3 storekeepers, and 859 mobilizers.

VectorLink Ethiopia will take a serious look at why female participation declined in 2019 despite project efforts to promote the hiring of female seasonal workers. Increasing female participation in the 2020 spray season is a major project goal.

9. CAPACITY BUILDING

In 2019, the VectorLink Ethiopia project continued to build the capacity of key governmental staff at the central, regional, zonal, and district levels; the ultimate goal is for the FMOH/NMCP to implement IRS completely on its own. Project capacity building takes various forms.

As already discussed, the project does training before the IRS campaign begins. In 2019, the project built supervisory skills of national, regional, zonal, and district staff by incorporating into IRS training programs two staff from the NMCP, two staff each from the three PMI target regions, one staff from each of the nine PMI target zones, and five staff from each of the 44 PMI target districts. Subsequently, in coordinating with the NMCP, RHBs, and district-level staff to supervise and monitor IRS operations, it provided on-the-job capacity building.

VectorLink Ethiopia also has been working with nine local universities (Addis Ababa, Jimma, Mekelle, Jigjiga, Arba Minch, Dire Dawa, Assosa, Debre Marcos, and Gondar) to build their skills in conducting entomological monitoring and insecticide resistance monitoring so they can serve as training and resource centers on these topics in the future. In 2019, the project conducted a four-day training on insecticide resistance and *An. stephensi* surveillance for 23 staff from the nine local universities, the NMCP, the Ethiopia Public Health Institute (EPHI), and the Armauer Hansen Research Institute (AHRI).

In April 2019, VectorLink Ethiopia supported the NMCP in holding a three-day workshop to finalize a manual on planning malaria control activities, including IRS and entomological surveillance. Thirty people attended. VectorLink made important technical contributions to the manual. The workshop improved NMCP and RHB officials' understanding of malaria planning including IRS microplanning, and it will guide districts in their IRS planning.

Also in a workshop, held in May 2019, the project provided technical support for the NMCP in developing tools and protocols to be used for vector foci investigations in pre-elimination districts. The tools will be used to support entomological surveillance, which includes breeding site identification.

In mid-September 2019, VectorLink Ethiopia in collaboration with the NMCP will conduct a five-day training on environmental compliance, spray quality, and new developments in IRS. The training will equip participants with adequate knowledge and skills in environmental compliance and basic IRS to ensure environmental compliance standards are followed. The training also aims to improve participants' training/facilitation and supervision skills so they can assure quality of IRS implementation.

In October 2019, VectorLink Ethiopia in collaboration with the NMCP will hold a three-day workshop to finalize the IRS training manual. The workshop will have 30 participants from NMCP, RHBs, and IRS implementing partners. The manual will improve the quality of IRS implementation by ensuring that IRS standards are followed.

Through these capacity-building activities, VectorLink Ethiopia seeks to:

- Build supervisory skills of government staff through training programs and sharing tools on IRS planning and implementation, M&E, procurement and logistics, and environmental compliance issues.
- Build capacity of local universities and EPHI to monitor entomological parameters and be able to make sound decisions for better vector control.
- Build capacity in an equitable manner and begin to address historic inequities in opportunities for men and women to learn these skills in Ethiopia

10. POST-SPRAY ACTIVITIES

10.1 POST-SPRAY INVENTORY

To ensure safe and effective completion of the spray season, the VectorLink Ethiopia team decommissioned the operations sites and conducted post-spray inventory activities. All IRS materials and equipment were returned to the district warehouses. All equipment was checked to ensure it was fully functional. Broken equipment was identified and will either be repaired before the start of the 2020 IRS campaign or, if unsalvageable, like plastic sheets, will be disposed of according to environmental compliance protocols by November 30, 2019.

The quantity and functionality of all other IRS materials and equipment in all districts was checked and documented to help plan for the next spray season. All insecticide-contaminated waste generated from operations will be disposed of by November 30, 2019, in compliance with environmental regulations and using disposal facilities available in Ethiopia.

After the 2019 spray season, 25,700 bottles of Actellic 300CS, expiring in December 2020, remained (Annex D). All this leftover insecticide has been transported to the central warehouse in Addis Abba for safe and secure keeping until the 2020 spray season. The VectorLink Ethiopia team will follow PMI BMP in transporting and storing these insecticides.

10.2 POST-SPRAY REVIEW MEETINGS

Regional post-season evaluation meetings will be held after the post-spray data audit. Key stakeholders, including PMI, FMOH, RHBs, zonal heads and MFPs, district MFPs and DHOs heads, and the VectorLink Ethiopia technical team will attend. Discussions will focus on results, lessons learned, and recommendations for future IRS activities.

II. CHALLENGES AND LESSONS LEARNED

II.1 CHALLENGES

The 2019 IRS campaign saw a marked reduction in the number and magnitude of challenges as compared with the 2018 campaign. Major challenges were the following:

Security Concerns:

- As discussed above, there was civil unrest in some areas targeted for IRS. The security issues had mostly negative (and one positive) effects on the spray campaign. Fortunately, no incident was recorded as a result of the unrest.
- To minimize security risks to personnel, VectorLink Ethiopia suspended spray activities in kebeles where civil conflicts took place and delayed the start of IRS operations in some districts. These delays extended the spray campaign and increased the number of days that project staff spent in the field and, in some cases, led to refusals of IRS.
-
- The instability also led to significant population displacement in some districts. As a result, the project found a significant number of structures vacated or demolished, especially in Kamashi Zone of Benishangul-Gumuz Region. See Section 4.4, Table 8 for details.
- While the extended campaign duration was an endurance challenge for the team, the reduced number of districts sprayed simultaneously made supervision more manageable.

Supervision and Monitoring of IRS Operations:

- At the start of the campaign, there was inadequate homeowner preparation in some districts. This happened especially in farming communities, where many beneficiaries stored massive amounts of grains indoors, and the grain was cumbersome to move. In three districts of Southwest Shoa Zone in Oromia Region, the project interrupted the campaign for one day to re-train the spray teams and send them a strong message about the zero-tolerance for improper household preparation. This re-training, and adequate mobilization and supervision solved the problem.
- National exams and the attempted coup in Amhara Regional State caused massive internet interruptions. This prevented supervisors from synchronizing their tablets to the server on a daily basis and made it challenging for senior management to take corrective actions in real time.
- The VectorLink Ethiopia team discovered that language barriers prevented most district supervisors from using supervisory checklists. The project will ensure that all checklists are translated into local languages.

Payment of Seasonal Workers and Breakfast Vendors:

- Even though the mobile payment system is simple, secure and obviates the need for VectorLink Ethiopia staff to travel with cash to the areas of disbursement, there were challenges related to

cash-out as most districts did not have banks or agents to pay the seasonal workers. The challenges were compounded by severe interruptions of the mobile phone system during the campaign. These affected supervision as most VectorLink supervisors spent more time resolving payment issues.

- The project faced several challenges regarding the payment of vendors contracted to provide breakfast in the districts. Most districts are remote and rural and therefore have few vendors; most vendors selected were small businesses that could not provide the required standard documentation for effecting mobile payments. The project did not have administrative staff to support collection of documents and processing of vendor payments. This affected supervision as most supervisors spent time dealing with the vendor payment issues.

Data Quality:

- Data quality challenges varied by district but one common issue was discrepancies between data recorded on the IRS card and actual information on the ground. The problem was minimized by conducting intensive data verifications and focused supervisions.

Female Participation:

- A very low percentage of female workers were recruited for the 2019 IRS campaign; most of those recruited were government staff and SOPs.

11.2 LESSONS LEARNED AND RECOMMENDATIONS

VectorLink Ethiopia ensured that the RHBs were highly engaged in planning, implementation, and supervision for the 2019 IRS season. This contributed to the improved 2019 IRS results.

The increase in the ratio of SQLs to SOPs significantly decreased the amount of time SOPs spent waiting for SQLs to reach them to record data. However, this reduced data collection burden did not translate into increased supervision. Based on the results of the SOP data collection pilot, the project highly recommends transitioning back to a 1:4 SQL: SOP ratio and having the SOPs record their own spray data. The SQLs will do supervision exclusively, ensuring spray quality and data quality.

Based on the recommendations by the PMI VectorLink Director of Vector Control Allan Were during his 2019 STTA, VectorLink Ethiopia will reinforce standard operating procedures to ensure that environment compliance and safety are maintained. The team will create user-friendly guidelines adapted to the Ethiopian context, which will also contain process flow charts and guidelines for the morning and evening activities at operations sites that double as camping grounds.

In 2020, the project will incorporate the PMI VectorLink storekeeper training curriculum to standardize processes and procedures across the supply chain based on the recommendation from the Director of Vector Control's STTA.

The project trained and hired M&E assistants for the first time in 2019. The M&E assistants helped to improve the quality of data and to increase spray coverage using the Data Collection Verification tool. DCVs were previously done by MFPs, which was not effective or reliable.

Provision of breakfast to the IRS workers significantly improved their commitment to stay in the field until the day's targets were met. But payment of the vendors providing breakfast was a major challenge partly because of limited staff to manage finance and procurement-related tasks in the field. The project recommends hiring more workers to ensure efficient procurement of breakfast services and financial management for seasonal workers payments.

To address the challenges the project experienced in making mobile payments to seasonal workers, in 2020, it will strengthen its financial operations and staffing structure to ensure efficient and appropriate payment systems are in place in each district.

The project procured fewer vehicles from a larger number of vendors in 2019, and this enabled better fleet management. This will be recommended for future IRS campaigns. Though renting buses instead of some trucks improved compliance with transportation standards, buses in some areas were not efficient because of the terrain.

The decision to convert temporary wash areas into cemented ones in 64 IRS operations sites improved environmental compliance and safety. The rest of the wash bays should be converted to cement. It also was observed that the pre-fabricated bathrooms were cost effective, because they are reusable and provide better privacy, especially for women.

During the pilot of Goizper pumps in Waliso District, SOPs observed as improvements that the pumps were light weight, increased visibility, and had better pressure gauges and backpack straps compared with the Hudson pumps. The team recommends using more Goizper pumps in future campaigns.

The VectorLink Ethiopia team will work with the RHBs to have a concrete plan for increasing women's participation at all levels.

ANNEX A: ADJUSTED STRUCTURE TARGET FOR GAMBELA REGION

Table A-1: Adjusted Structure Target for Gambela Region

Zone	District	Structures Found during 2018 IRS Campaign	Digital Globe Satellite Enumeration Estimate	Eligible Structures Found During Enumeration	Adjusted Target	Remark
Agnuwa	Gog	4,339	13,170	7,071	7,071	
	Abobo	6,527	7,865	5,456	6,527	2018 structures found were used for 2019 target
	Dimma	3,846	10,861	8,262	8,262	
	Jor	2,671	3,090	2,464	2,671	2018 structures found were used for 2019 target
	Gambela	2,842	41,762	4,397	4,397	
Gambela Town	Gambela Town	9,425		31,444	9,562	RHB and VectorLink agreed to exclude the urban zones
Itang Special	Itang Special	7,610	48,744	14,203	7,530	Target was adjusted due to security issues and seasonal movement of people within the district
Majang	Godere	9,637	18,187	8,404	9,637	2018 structures found were used for 2019 target
	Mengeshi	8,380	13,597	9,196	9,196	
Nuer	Akobo	8,775	949	1,991	8,775	2018 structures found were used for 2019 target
	Jikow	7,704	13,696	7,755	7,755	
	Makuey	7,411		11,322	11,322	
	Lare	11,189	12,483	11,669	11,669	
	Wanthoa	8,611	8,087	9,446	9,446	
Total		98,967	192,491	133,080	113,820	

ANNEX B: PROCUREMENT

Table B-I: International Procurements

Item	Quantity Required	Opening Balance	Quantity Procured	Total at Start of Campaign	Quantity Used	Quantity Damaged	Total at End of Campaign
Actellic 300CS (bottles)	50,000	97,465	50,004	147,469	121,769		25,700
Ceramic nozzle tips (8002E) (yellow)	4,230	8,030	-	8,030	2,300		5,730
Rubber gloves - short (pair)	4,000	-	2,000	2,000	2,000		-
Rubber gloves - medium (pair)	6,616	17,669	4,616	22,285	1,231		21,054
Nose masks (pieces)	120,958	138,640	120,960	259,600	184,120		75,480
CFV (red)	1,262	2,600	-	2,600	1,338		1,262
CFV gaskets (white)	1,262	2,500	-	2,500	1,300		1,200
Hudson X-pert spray pump	207	348	-	348	101	34	213
Goizper pump	-	-	15	15	15	-	15
Spare part kit	10	117	-	117	4		113
Helmet	2,100	1,493	2,112	3,605	1,730	6	1,869
Face shield (each)	4,069	1,026	4,100	5,126	2,020		3,106
Face shield carrier (each)	3,669	595	4,100	4,695	2,020		2,675
Rubber boots - male (size-10)	200	-	200	200	122		200
Rubber boots - male (size-11)	200	-	200	200	56		200
Rubber boots - male (size-12)	100	-	100	100	70		100
Rubber boots - male (size-13)	100	-	100	100	40		100
Rubber boots - male (size-8)	200	-	200	200	116		200
Rubber boots - male (size-9)	100	600	100	700	694		700
Rubber boots - female (size-4)	200	-	200	200	140		200
Rubber boots - female (size-5)	200	-	200	200	115		200
Strainer for spray pump	1,500	1,866	-	1,866	-		1,866
Rubber gloves - long (pair)- 26 inch extra large	200	-	200	200	119		81
Nozzle tip gaskets (black)	1,500	3,500	-	3,500	2,240		1,260

Table B-2: Local Procurements

Item	Quantity Required	Opening Balance	Quantity Procured	Total at Start of Campaign	Quantity Used	Quantity Damaged	Total at End of Campaign
Coverall	3,700	2,870	-	2,870	2,309		2,870
Reflective jacket	223	11	223	234	234		234
Big washing basin	100	-	100	100	79		100
Bucket 20 Lit	150	2	150	152	17		152
1 Liter Jog	212	-	212	212	212		212
2 Liter Jug	100	225	100	325	269		325
2000 Li tanker	5	5	-	5	5		5
220 Li. Barrel	50	4	60	64	43		64
Water Filter- made of plastic/metal	1,500	-	-	-			-
Tool Kit Bag Canvas	60	200	60	260	20		260
Combination Pilar 8"	60	200	60	260	20		260
Adgustable wrench 12"	60	200	60	260	20		260
Screw Driver	60	200	60	260	20		260
Plastic apron	20	-	20	20	20		20
First aid kit	170	7	170	177	131		177
Torch/ Flash light	1,147	11	1,147	1,158	1,153		1,158
Plastic sheet	92	-	92	92	92		92
Duffel bag	350	-	350	350	322		350
Toilet soap small	22,932	10,456	22,932	33,388	33,388		-
Laundry soap Big	9,027	6,500	9,027	15,527	15,527		-
Rope of 20 meter	20	-	-	-	-	-	-
Towel	447	380	-	380	320		380
Dust Brush with pan	170	-	170	170	26		170
Padlocks	110	216	110	326	94		326
Neck protection	650	188	650	838	838		838
Spray Operator bag	500	2	500	502	425		502
Dry battery cell	6,152	-	6,152	6,152	6,123		6,152
Chalk	375	10	375	385	133		252
Bag for M&E assistants	50	-	50	50	50		50
Data Entry Clerk Labtops	5	71	5	76	74		76
Female sanitary Napkins	1,000	-	1,000	1,000	880		120
Weighing scale for the Central Warehose	2	-	2			-	-
Socks	6,000	-	6,000	6,000	5,680		320
Megaphone	88	-	-	-			-
Squad leader- Bag	350	-	350	350	350		350
Box-Files	264	-	264	264	264		264
Printing of T-shirt	2589	1,100	-	1,100	800		300
Galvanized Metallic	378	-	378	378	378		378

Item	Quantity Required	Opening Balance	Quantity Procured	Total at Start of Campaign	Quantity Used	Quantity Damaged	Total at End of Campaign
shelf 2m height with a 4 plates							
Prefabs- pit bathrooms for Operational sites	44	-	44	44	44		44

ANNEX C: DATES AND DURATION OF SPRAY CAMPAIGN BY DISTRICT

Table C-1: Campaign Length by District

Region	Zone	District	Campaign Details		
			Spray Days	Spray Start Date	Spray End Date
Gambela	Agnuwa	Abobo	21	20-May	15-Jun
		Dimma	17	20-May	08-Jun
		Gambela Z	19	20-May	14-Jun
		Gog	21	21-May	14-Jun
		Jor	13	21-May	05-Jun
	Gambela Town	Gambela Town	15	20-May	07-Jun
	Itang Special	Itang Special	16	21-May	07-Jun
	Majang	Godare	17	20-May	08-Jun
		Mengeshi	17	20-May	08-Jun
	Nuer	Akobo	17	20-May	07-Jun
		Jikow	18	20-May	08-Jun
		Lare	18	20-May	08-Jun
		Makuey	18	20-May	08-Jun
		Wanthoa	18	20-May	08-Jun
	Benishangul-Gumuz	Assosa	Assosa	33	05-Jun
Bambasi			34	03-Jun	12-Jul
Homosha			30	06-Jun	10-Jul
Kumruk			29	07-Jun	10-Jul
Menge			24	03-Jun	07-Jul
Oda Buldigilu			30	03-Jun	06-Jul
Sherkole			30	06-Jun	10-Jul
Kamashi		Agalo Mete	13	08-Jul	22-Jul
		Belo Jegenfoy	09	08-Jul	17-Jul
		Kamashi	11	08-Jul	19-Jul
		Sedal	26	03-Jun	08-Jul
		Yaso	12	08-Jul	20-Jul
Mao-Komo Special		Mao-Komo Special	32	05-Jun	10-Jul
Metekel		Bullen	30	17-Jun	21-Jul
		Dangure	30	17-Jun	21-Jul
	Dibate	30	17-Jun	22-Jul	
	Guba	25	18-Jun	18-Jul	
	Mandura	09	17-Jun	26-Jun	
	Pawe	30	17-Jun	21-Jul	
Wombera	30	18-Jun	20-Jul		
Oro	Horo Gudro Wellega	Abay Chomen	30	03-Jun	08-Jul

Region	Zone	District	Campaign Details		
			Spray Days	Spray Start Date	Spray End Date
		Abe Dengoro	30	05-Jun	09-Jul
		Amuru	30	05-Jun	09-Jul
		Jardega Jarte	30	03-Jun	06-Jul
	South West Shoa	Goro	29	03-Jun	08-Jul
		Ilu	29	03-Jun	07-Jul
		Waliso	27	03-Jun	05-Jul
	West Guji	Abaya	28	20-May	24-Jun
		Gelana	28	20-May	22-Jun
		Melka Soda	28	20-May	20-May

ANNEX D: INSECTICIDE USAGE

Table D-1: Insecticide Usage by District

Zone	District	Structures Sprayed	Bottles Used	Avg Sprayed Structures per Bottle	Avg Bottles per SOP per Day	Structures Sprayed per Day per SOP
Agnuwa	Agnuwa Total	25806	3551	7.3	2.3	16.5
	Abobo	5606	779	7.2	2.0	14.2
	Dimma	7889	1292	6.1	3.2	19.4
	Gambela Z	3794	436	8.7	2.0	17.2
	Gog	6165	733	8.4	1.7	14.2
	Jor	2352	311	7.6	2.8	21.2
Gambela Town	Gambela Town Total	10647	2552	4.2	4.4	18.4
	Gambela Town	10647	2552	4.2	4.4	18.4
Itang Special	Itang Special Total	6974	1335	5.2	3.5	18.4
	Itang Special	6974	1335	5.2	3.5	18.4
Majang	Majang Total	17331	3108	5.6	3.1	17.3
	Godare	8640	1665	5.2	3.1	16.1
	Mengeshi	8691	1443	6.0	3.1	18.7
Nuer	Nuer Total	46415	8595	5.4	3.4	18.4
	Akobo	8985	1339	6.7	3.1	21.0
	Jikow	7174	1334	5.4	3.4	18.2
	Lare	11402	2137	5.3	3.1	16.7
	Makuey	10130	1800	5.6	3.9	21.7
	Wanthoa	8724	1985	4.4	3.6	15.9
Assosa	Assosa Total	138563	25279	5.5	3.4	18.8
	Assosa	32042	4668	6.9	2.8	19.0
	Bambasi	17137	3745	4.6	3.4	15.4
	Homosha	10386	2193	4.7	3.1	14.8
	Kumruk	9127	2114	4.3	4.5	19.5
	Menge	32011	5639	5.7	4.1	23.3
	Oda Buldigilu	21950	3326	6.6	3.1	20.4
	Sherkole	15910	3594	4.4	3.8	16.8

Zone	District	Structures Sprayed	Bottles Used	Avg Sprayed Structures per Bottle	Avg Bottles per SOP per Day	Structures Sprayed per Day per SOP
Kamashi	Kamashi Total	22587	5656	4.0	4.4	17.4
	Agalo Mete	5622	1271	4.4	5.1	22.4
	Belo Jegenfoy	3074	638	4.8	3.1	15.1
	Kamashi	3577	1263	2.8	6.0	17.1
	Sedal	6213	1418	4.4	3.7	16.3
	Yaso	4101	1066	3.8	4.3	16.4
Mao-Komo Special	Mao-Komo Special Total	24731	5574	4.4	4.0	18.0
	Mao-Komo Special	24731	5574	4.4	4.0	18.0
Metekel	Metekel Total	56958	13966	4.1	4.1	16.9
	Bullen	10503	3288	3.2	6.2	19.7
	Dangure	7384	1373	5.4	2.7	14.4
	Dibate	14852	4406	3.4	5.0	17.0
	Guba	4427	559	7.9	2.2	17.6
	Mandura	3463	747	4.6	3.2	14.9
	Pawe	11397	2550	4.5	4.0	18.0
	Wombera	4932	1043	4.7	3.0	14.3
Horo Gudro Wellega	Horo Gudro Wellega Total	55016	19932	2.8	5.7	15.8
	Abay Chomen	12053	4692	2.6	5.9	15.1
	Abe Dengoro	25073	9156	2.7	6.1	16.7
	Amuru	8991	3504	2.6	5.9	15.2
	Jardega Jarte	8899	2580	3.4	4.5	15.4
South West Shoa	South West Shoa Total	43659	16377	2.7	5.6	15.0
	Goro	13306	4611	2.9	4.9	14.1
	Ilu	15134	6246	2.4	6.6	16.1
	Waliso	15219	5520	2.8	5.4	14.8
West Guji	West Guji Total	39059	15843	2.5	6.4	15.8
	Abaya	15796	5780	2.7	5.8	15.9
	Gelana	13751	6175	2.2	7.3	16.2
	Melka Soda	9512	3888	2.4	6.1	14.9
Grand Total		487,746	121,768	4.0	4.3	17.2

ANNEX E: SPRAY PROGRESS AND COVERAGE BY DISTRICT AND BY REGION

Table E-1: Spray Progress and Coverage by District

Zone	District	Spray Progress	Original Target	Adjusted Target	Found	Sprayed	Spray Coverage	Population Protected		
								Total	Pregnant Women	Children under 5
Agnuwa	Agnuwa Total	89%	28,928	28,928	26,978	25,806	96%	65,739	1,213	10,774
	Abobo	86%	6,527	6,527	5,942	5,606	94%	13,622	144	2,239
	Dimma	95%	8,262	8,262	8,291	7,889	95%	13,906	272	1,878
	Gambela Z	86%	4,397	4,397	3,897	3,794	97%	12,777	462	2,181
	Gog	87%	7,071	7,071	6,362	6,165	97%	18,177	185	3,207
	Jor	88%	2,671	2,671	2,486	2,352	95%	7,257	150	1,269
Gambela Town	Gambela Town Total	111%	9,562	9,562	10,822	10,647	98%	35,521	1,746	5,526
	Gambela Town	111%	9,562	9,562	10,822	10,647	98%	35,521	1,746	5,526
Itang Special	Itang Special Total	93%	14,203	7,530	7,909	6,974	88%	22,984	1,306	4,367
	Itang Special**	93%	14,203	7,530	7,909	6,974	88%	22,984	1,306	4,367
Majang	Majang Total	92%	18,833	18,833	18,409	17,331	94%	39,239	301	4,103
	Godere	90%	9,637	9,637	9,038	8,640	96%	21,166	136	1,832
	Mengeshi	95%	9,196	9,196	9,371	8,691	93%	18,073	165	2,271
Nuer	Nuer Total	95%	48,967	48,967	47,628	46,415	97%	146,922	12,222	39,977
	Akobo	102%	8,775	8,775	9,086	8,985	99%	24,724	3,171	7,783
	Jikow	93%	7,755	7,755	7,300	7,174	98%	27,328	1,529	6,751
	Lare	98%	11,669	11,669	11,535	11,402	99%	36,816	2,422	9,795
	Makuey	89%	11,322	11,322	10,505	10,130	96%	30,616	3,123	7,843
	Wanthoa	92%	9,446	9,446	9,202	8,724	95%	27,438	1,977	7,805
Gambela Total		94%	120,493	113,820	111,746	107,173	96%	310,405	16,788	64,747
Assosa	Assosa Total	92%	150,537	150,537	146,553	138,563	95%	271,456	3,921	43,489

Zone	District	Spray Progress	Original Target	Adjusted Target	Found	Sprayed	Spray Coverage	Population Protected		
								Total	Pregnant Women	Children under 5
	Assosa	90%	35,466	35,466	34,787	32,042	92%	65,371	651	7,903
	Bambasi	95%	18,082	18,082	18,859	17,137	91%	36,230	347	4,741
	Homosha**	91%	11,371	11,371	11,608	10,386	89%	17,645	199	2,974
	Kumruk	87%	10,491	10,491	9,328	9,127	98%	20,138	326	3,686
	Menge	96%	33,206	33,206	32,023	32,011	100%	52,342	1,013	10,438
	Oda Buldigilu	92%	23,960	23,960	23,822	21,950	92%	42,068	614	5,765
	Sherkole	89%	17,961	17,961	16,126	15,910	99%	37,662	771	7,982
Kamashi	Kamashi Total	95%	35,547	23,666	23,869	22,587	95%	67,145	1,404	11,966
	Agalo Mete	112%	7,436	5,000	5,741	5,622	98%	15,527	327	2,921
	Belo Jegenfoy	88%	7,376	3,491	3,183	3,074	97%	10,087	153	1,441
	Kamashi	94%	5,838	3,800	3,611	3,577	99%	9,717	163	1,314
	Sedal*	89%	6,950	6,950	7,141	6,213	87%	18,334	421	3,470
	Yaso	93%	7,947	4,425	4,193	4,101	98%	13,480	340	2,820
Mao-Komo Special	Mao-Komo Special Total	93%	26,573	26,573	24,975	24,731	99%	43,204	781	7,419
	Mao-Komo Special	93%	26,573	26,573	24,975	24,731	99%	43,204	781	7,419
Metekel	Metekel Total	102%	69,827	55,827	59,676	56,958	95%	189,220	2,547	27,605
	Bullen	118%	8,935	8,935	11,324	10,503	93%	36,049	495	5,303
	Dangure	91%	10,039	8,147	7,476	7,384	99%	28,877	358	4,263
	Dibate	102%	14,577	14,577	15,172	14,852	98%	51,297	677	7,782
	Guba	96%	5,756	4,615	4,438	4,427	100%	11,830	175	1,624
	Mandura	83%	14,699	4,180	4,180	3,463	83%	12,211	224	2,064
	Pawe	110%	10,318	10,318	12,036	11,397	95%	32,604	289	3,636
	Wombera	98%	5,503	5,055	5,050	4,932	98%	16,352	329	2,933
Benishangul-Gumuz Total		95%	282,484	256,603	255,073	242,839	95%	571,025	8,653	90,479
Horo Gudro Wellega	Horo Gudro Wellega Total	103%	53,371	53,371	56,043	55,016	98%	139,573	2,228	20,009
	Abay Chomen	103%	11,741	11,741	12,178	12,053	99%	28,050	395	3,132
	Abe Dengoro	107%	23,451	23,451	25,390	25,073	99%	53,862	692	6,800
	Amuru	98%	9,141	9,141	9,127	8,991	99%	32,454	628	5,242
	Jardega Jarte	98%	9,038	9,038	9,348	8,899	95%	25,207	513	4,835
South West Shoa	South West Shoa Total	94%	46,485	46,485	47,338	43,659	92%	134,959	1,511	17,391
	Goro**	92%	14,462	14,462	14,955	13,306	89%	44,700	553	6,680

Zone	District	Spray Progress	Original Target	Adjusted Target	Found	Sprayed	Spray Coverage	Population Protected		
								Total	Pregnant Women	Children under 5
	Ilu	95%	15,968	15,968	16,164	15,134	94%	39,144	348	4,327
	Waliso	95%	16,055	16,055	16,219	15,219	94%	51,115	610	6,384
West Guji	West Guji Total	99%	39,315	39,315	40,249	39,059	97%	178,906	4,065	35,636
	Abaya	97%	16,316	16,316	16,248	15,796	97%	63,527	1,151	10,542
	Gelana	102%	13,523	13,523	14,477	13,751	95%	75,873	1,964	17,247
	Melka Soda	100%	9,476	9,476	9,524	9,512	100%	39,506	950	7,847
Oromia Total		99%	139,171	139,171	143,630	137,734	96%	453,438	7,804	73,036
Grand Total		96%	542,148	509,594	510,449	487,746	96%	1,334,868	33,245	228,262

*Low coverage in Goro, Itang Special, and Homosha districts were due to a large number of refusals. Specifically in Goro district, homeowners were not willing to remove all their household goods, which in many cases included a large amount of grain.

*The low spray coverage in Sedal District is due a high number of locked structures. The VectorLink Ethiopia team confirmed that the locked houses belong to displaced persons who fled the area.

Note: Total campaign targets were adjusted/changed because some structures were not sprayed or visited due to the following reasons:

- i. Itang Special: 6,347 (20,310 estimated population) structures became ineligible because their households live in different locations during the dry and rainy seasons. In the dry season, households move to the banks of the Baro River; in the rainy season, they move to highlands to avoid flooding of the river. These people do not return to their homes until November. Additionally, internal conflict forced households in 4 kebeles to move to the neighboring kebeles. As a result, 326 (1,043 estimated population) structures were not visited.
- ii. Mandura: 10,519 structures (33,661 estimated population) could not be accessed because of active conflict in the area.
- iii. Guba: 394(1,261 estimated population) structures in two villages were not sprayed due to security risks. 747 (2,390 estimated population) structures in the Renaissance Dam area were excluded because the contractors who previously lived in these homes have ceased their employment.
- iv. Dangure: Due to conflict, spray teams did not visit 1,892 structures (6,054 estimated population).
- v. Wombera: 448 structures (1,434 estimated population) in three kebeles were excluded because the river was flooded, which cut off access to the kebeles.
- vi. 11,881 structures were excluded from the 4 Kamashi Zone target districts because houses were burned down and residents were displaced during internal conflicts; Agalo Meti (2,436 structures, 7,795 estimated population), Kamashi (2,038 structures, 6,522 estimated population), Belo Jegenfey (3,885 structures, 12,336 estimated population), and Yaso (3,522 structures, 11,270 estimated population).

Figure E-1: Regional Spray Progress

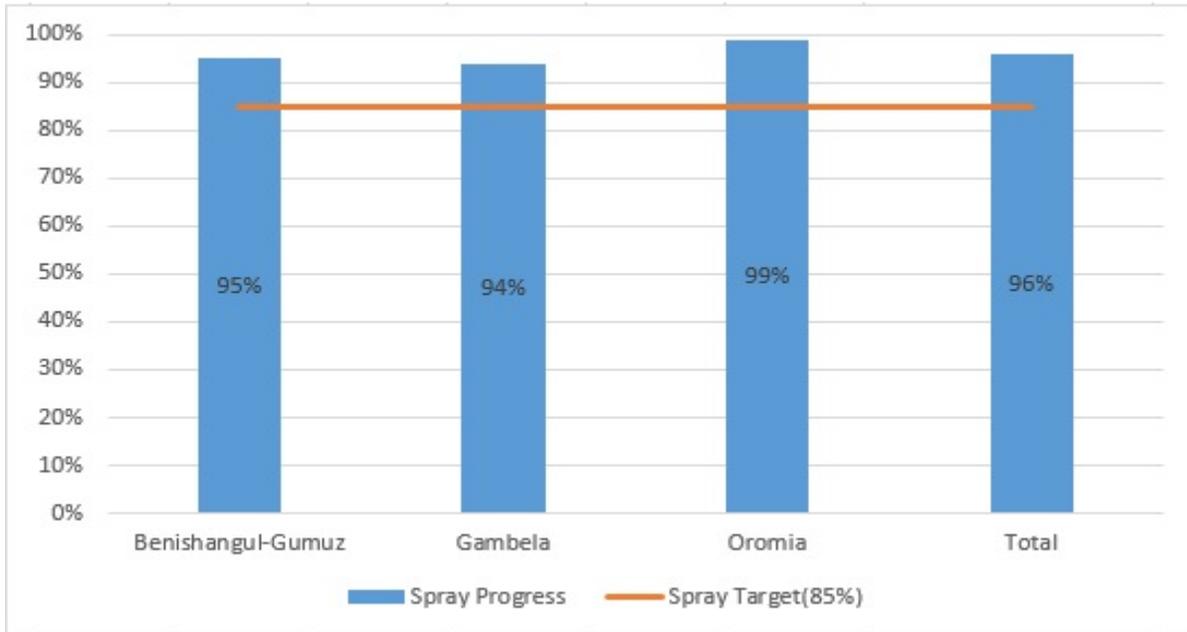


Figure E-2: Regional Spray Coverage

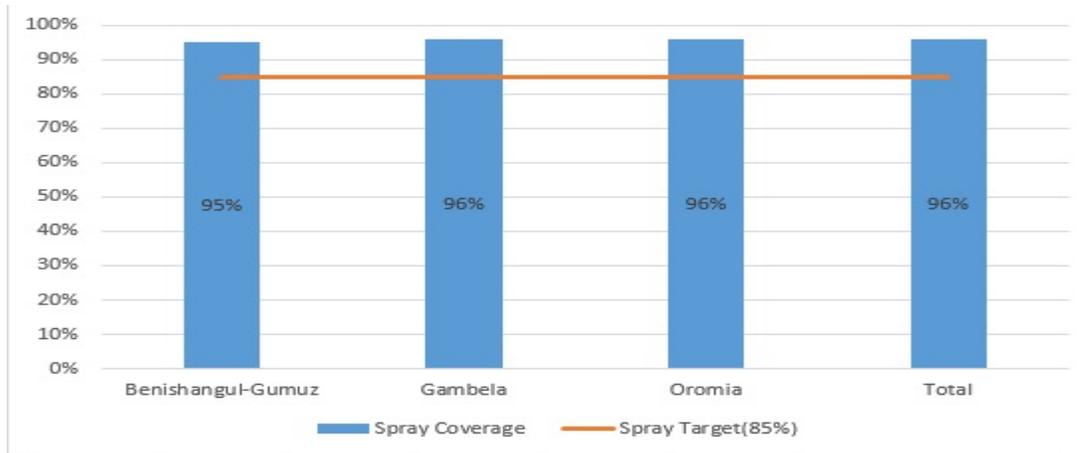


Figure E-3: Zonal Spray Progress, Gambela Region

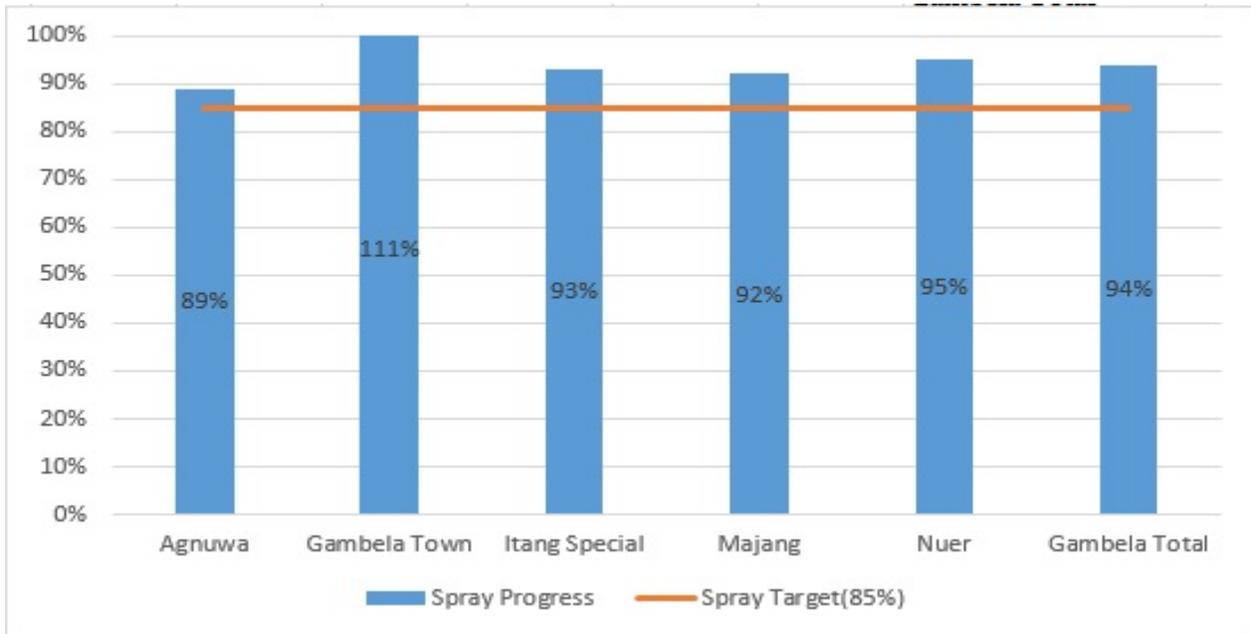


Figure E-4: Zonal Spray Coverage, Gambela Region

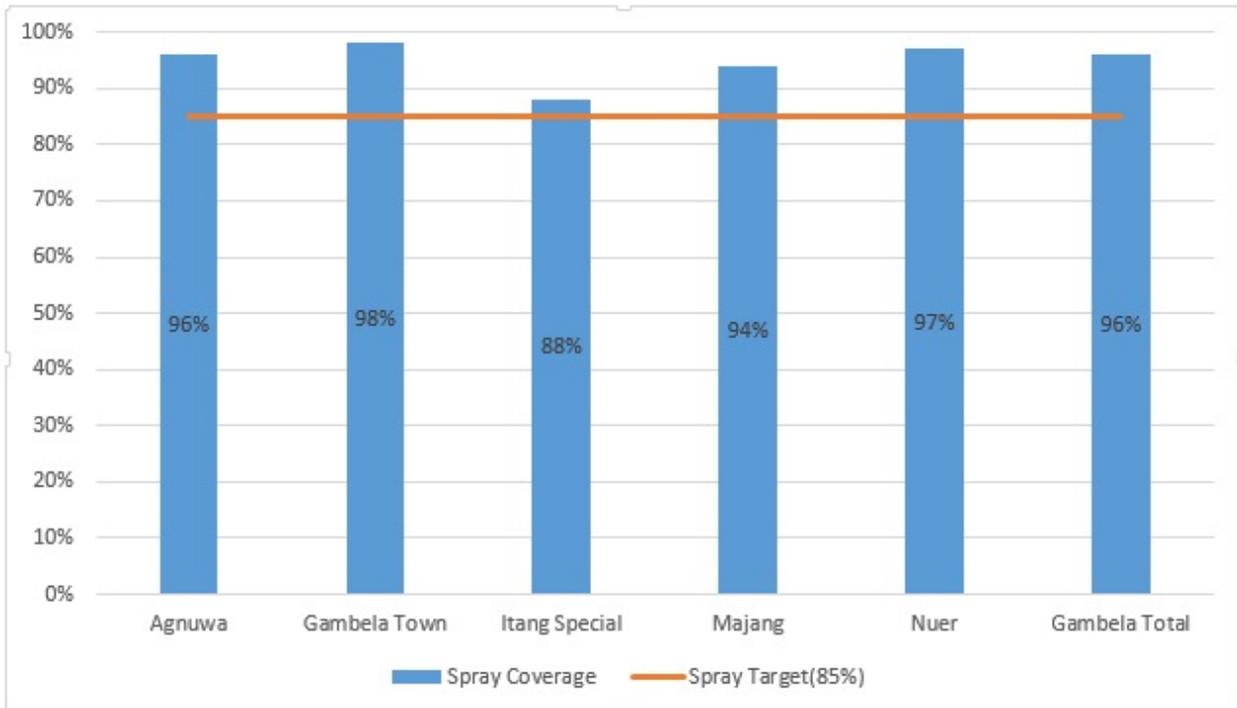
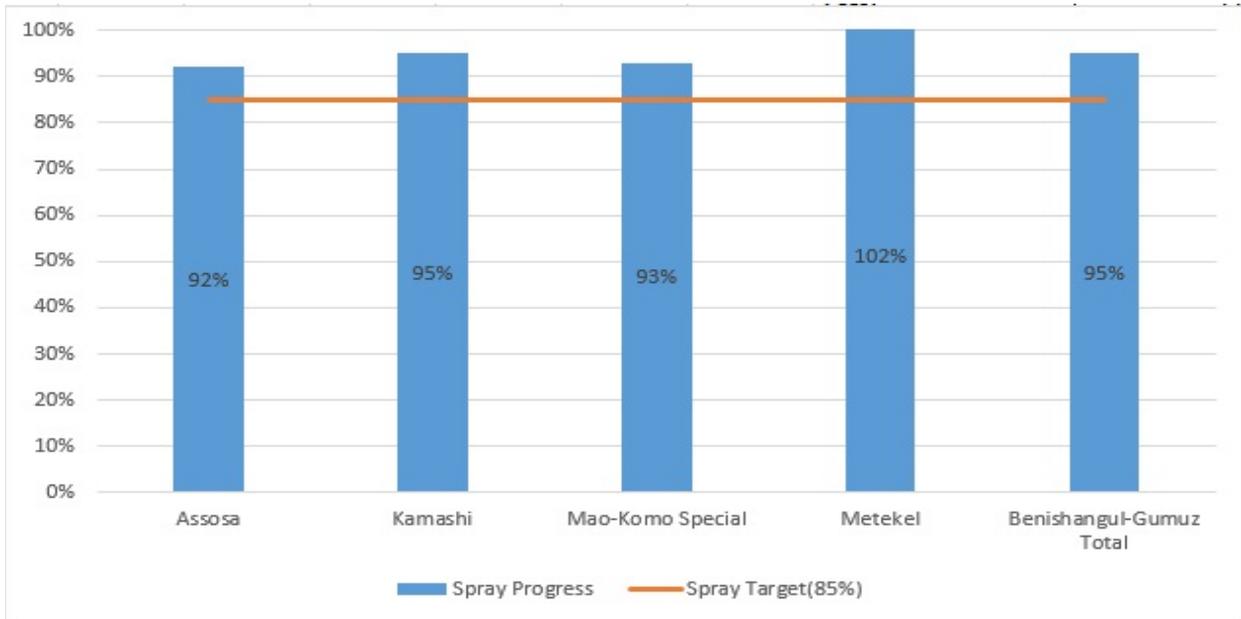


Figure E-5: Zonal Spray Progress, Benishangul-Gumuz Region



*Only a portion (about 50%) of eligible structures in Sinda District were targeted for spraying during the 2018 campaign.

Figure E-6: Zonal Spray coverage, Benishangul-Gumuz Region

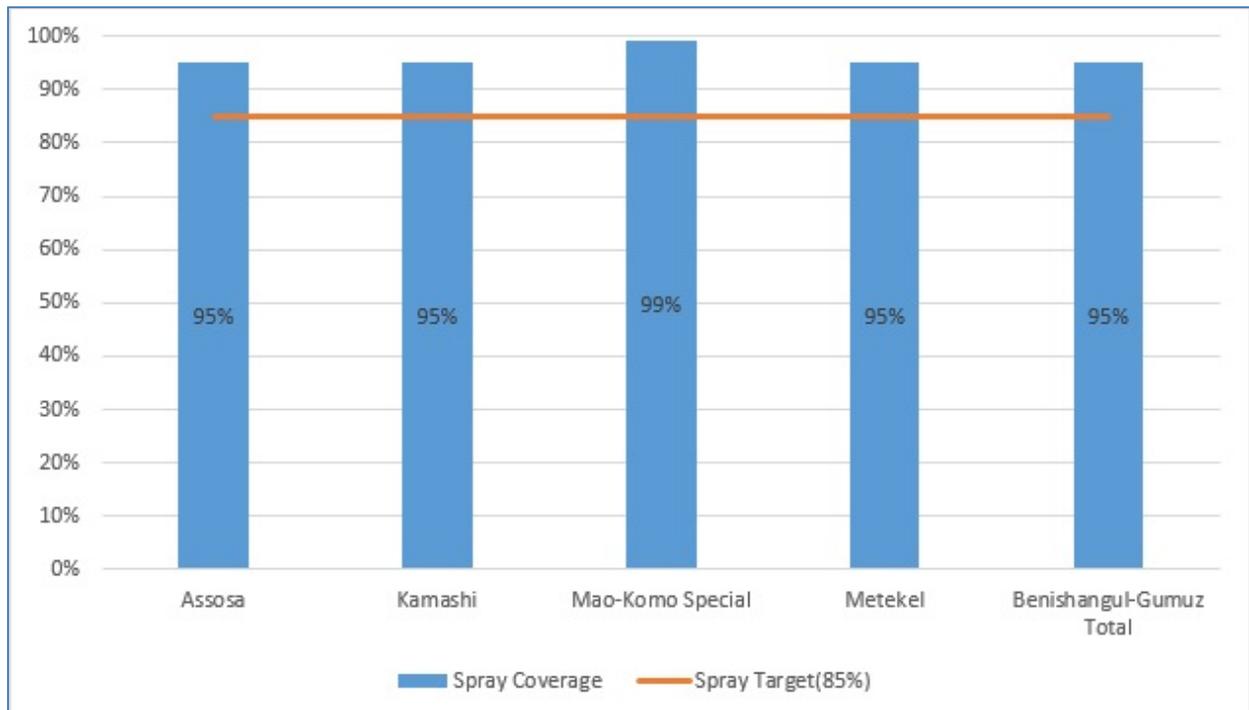


Figure E-7: Zonal Spray Progress, Oromia Region

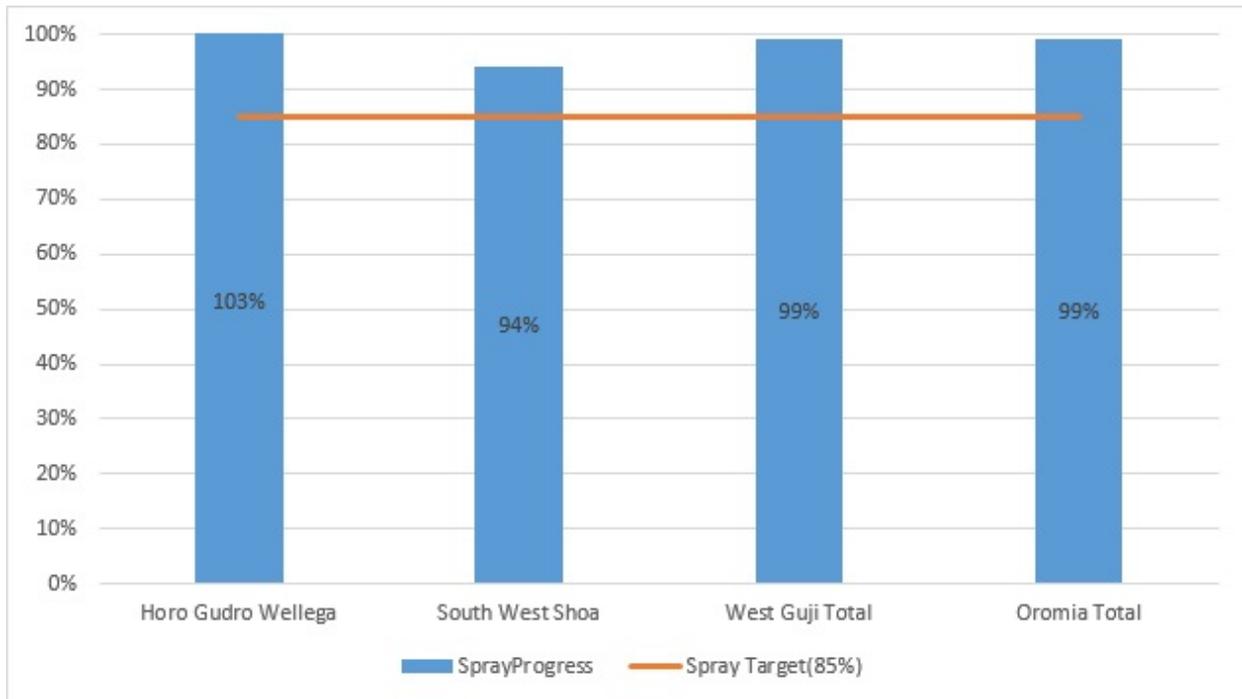
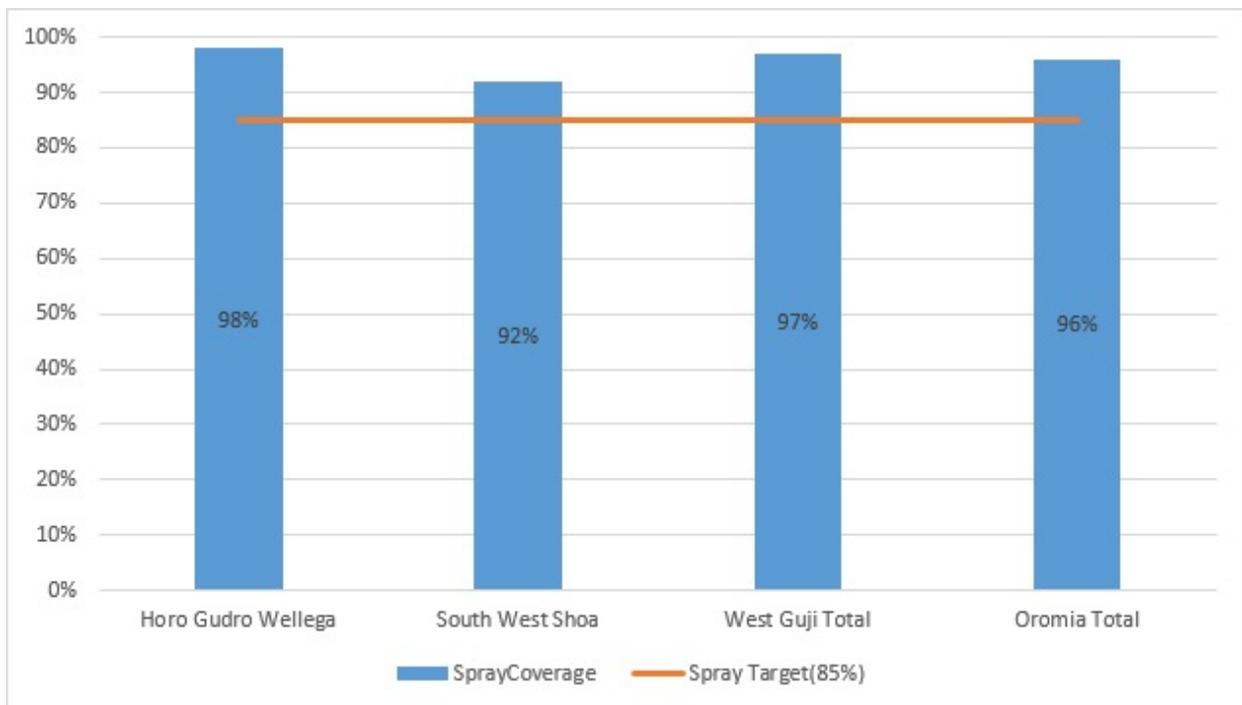


Figure E-8: Zonal Spray Coverage, Oromia Region



ANNEX F: M&E PLAN MATRIX – 2019 CAMPAIGN RESULTS

#	Performance Indicator	Data Source(s) and Reporting Frequency	Disaggregation(s)	Annual Targets and Results									
				Year 1		Year 2		Year 3		Year 4		Year 5	
				Target	Result	Target	Result	Target	Result	Target	Result	Target	Result
Objective 1: Implementation of Malaria Vector Control Interventions													
1.1 Successfully execute IRS and other malaria vector control programs													
1.1.1	Number and percentage of complete annual country work plans developed and submitted on-time	Project records Annually	Country	1; (100%)	1; (100%)	1; (100%)	1; (100%)						
1.1.2	Number of eligible structures targeted for spraying	Data source: Previous spray campaign data, enumeration data (targets); Daily Spray Operator Forms (results) Reporting frequency: Daily per spray campaign	By Spray Campaign	595,618 ³	574,042 ⁴	545,496 ⁵	509,594 ⁶						

³ Number of eligible structures targeted was based on the number of structures found in 2017 and microplanning data from RHBs.

⁴ Number of targeted structures is lower than the Y1 target because the IRS team couldn't visit/access conflict areas. In addition, roadblocks and high river levels prevented access in some districts and an overestimation of structures in new PMI-supported districts inflated the campaign target.

⁵ Number of eligible structures targeted was based on the number of structures found in 2018, structures that were not covered in 2018 spray campaign due to security reasons, and an enumeration that was done in Gambela Region. Moreover, additional kebeles that were not previously targeted in the Oromia region are included. Number of eligible structures targeted for spraying is lower than the Y2 target because the IRS team couldn't visit kebeles that had security problems. Moreover, a significant number of structures were vacant since residents moved to a different location to avoid flooding. These homes will not be re-inhabited for several months.

#	Performance Indicator	Data Source(s) and Reporting Frequency	Disaggregation(s)	Annual Targets and Results									
				Year 1		Year 2		Year 3		Year 4		Year 5	
				Target	Result	Target	Result	Target	Result	Target	Result	Target	Result
I.1.3	Number of eligible structures sprayed with IRS	Data source: Daily Spray Operator Forms Reporting frequency: Daily per spray campaign	By Spray Campaign	506,275 ⁷	472,569 ⁸	463,672 ⁹	487,746						
I.1.4	Percentage of total structures found that were sprayed with a residual insecticide (Spray Coverage)	Project records Annually	Country	85%	97%	85%	96%						
I.1.5	Number of people protected by IRS	Data source: Daily Spray Operator Forms Reporting frequency: Daily per spray campaign	By Spray Campaign By Gender By pregnant women By children <5 years old	1,622,386	1,264,189 ¹⁰ Male: 633,359 Female: 630,830 Pregnant women: 28,944 Children <5: 213,459	1,496,124	1,334,868 ¹¹ Male: 668,769 Female: 666,099 Pregnant women: 33,245 Children <5: 228,262						
I.1.6	Number and percentage of vector control	Project Annually	Country	I; (100%)	I; (100%)	I; (100%)	I; (100%)						

⁷ 85% of target (85% * 595,618)

⁸ Number of eligible structures sprayed is low because IRS teams couldn't access conflicts areas and there was an overestimation of structures in some new PMI-supported districts.

⁹ 85% of target (85%*545,496)

¹⁰ Sex segregation was done based on the 2017 projection in the document "Federal Democratic Republic of Ethiopia Central Statistical Agency Population Projection of Ethiopia for All Regions at Woreda Level from 2014 – 2017," where males comprise 50.1% of the population and females 49.9%.

¹¹ Sex segregation was done based on the 2017 projection in the document "Federal Democratic Republic of Ethiopia Central Statistical Agency Population Projection of Ethiopia for All Regions at Woreda Level from 2014 – 2017," where males comprise 50.1% of the population and females 49.9%.

#	Performance Indicator	Data Source(s) and Reporting Frequency	Disaggregation(s)	Annual Targets and Results									
				Year 1		Year 2		Year 3		Year 4		Year 5	
				Target	Result	Target	Result	Target	Result	Target	Result	Target	Result
	project country programs submitting an EOSR within 45 days after the end of spray (including completing MEP and EMMR)												
I.1.7	Number of IRS country programs that conduct a Post-spray Data Quality Audit within 90 days of spray completion	Data Collection Forms Annually	Country	N/A	N/A	1; (100%)	1 (100%)						
I.1.8	Number of Insecticide Treated Nets (ITNs) distributed, by channel	Project Records Annually	Country Channel	N/A	N/A	N/A	N/A						
I.1.9	Number and percentage of ITN country programs that conduct at least one process assessment of the quality of ITN distribution planning, the quality of household registration, and or ITN distribution implementation during a mass ITN distribution campaign	Project Records Annually	Country Channel	N/A	N/A	N/A	N/A						
I.1.10	Number and percentage of ITN country programs with operational	Project Records Annually	Country Channel	N/A	N/A	N/A	N/A						

#	Performance Indicator	Data Source(s) and Reporting Frequency	Disaggregation(s)	Annual Targets and Results										
				Year 1		Year 2		Year 3		Year 4		Year 5		
				Target	Result	Target	Result	Target	Result	Target	Result	Target	Result	
	routine monitoring systems for continuous ITN distribution, disaggregated by channel													
1.1.1.1	Number and percentage of countries completing ITN durability monitoring data collection on time as planned in a given project year	Project Records Annually	Country	N/A	N/A	N/A	N/A							
1.2	Provide technical assistance and planning support for IRS and other integrated malaria vector control activities													
1.2.1	Number of VC project training workshops targeting NMCP and other host country staff	Project Training Records Annually	Country Technical Area Job Function	0	0	1	0 ¹²							
1.2.2	Number of NMCP and other vector control host country staff accessing DHIS2	DHIS2 Logs Annually	Country Job Function	N/A	N/A	N/A	N/A							
1.3	Ensure safe and judicious use of insecticides and other malaria vector control products													
1.3.1	Number of vector control personnel trained in environmental compliance and	Data source: Project records – Training reports Reporting	By Sex (# and %) Job Function	2,628	2,751 ¹³ Male: 2,445 (89%)	3,241	3,054 ¹⁴ Male: 2,624 (86%)							

¹² PMI VectorLink Ethiopia has planned to organize the training on October/November, 2019

¹³ TOT participants (276), SQLs (393), SOPs (1,378), Porter (324), Washers (82), Drivers (129), Guards (81), Storekeepers (44) and Storekeeper assistants (44).

¹⁴ TOT participants (292), SQLs (644), SOPs (1,361), Porter (334), Washers (108), Drivers (145), Guards (87), Storekeepers (39) and Storekeeper assistants/pump technicians (44).

#	Performance Indicator	Data Source(s) and Reporting Frequency	Disaggregation(s)	Annual Targets and Results											
				Year 1		Year 2		Year 3		Year 4		Year 5			
				Target	Result	Target	Result	Target	Result	Target	Result	Target	Result		
	personal safety standards in vector control implementation	frequency: Each spray season			Female: 306 (11%)		Female: 430 (14%)								
I.3.2	Number of health workers receiving insecticide poisoning case management training	Project Training Records Annually	By Sex (# and %)	132	103 Male: 90 (87%) Female: 13 (13%)	132	79 Male: 60 (76%) Female: 19 (24%)								
I.3.3	Number of adverse reactions to pesticide exposure documented	Incident Report Forms Annually	Country Type of Exposure	0	0	0	0								
I.4	Strengthen capacity of NMCPs, vector control personnel, and other institutions to implement and manage IRS and other vector control activities														
I.4.1	Total number of people trained to support VC in targeted areas	Project Training Records Annually	By Sex (# and %) VC Intervention Type	4,539	4,371 ¹⁵ Male: 2,953(68%) Female: 1,418 (32%)	5,159	4,887 ¹⁶ Male: 3,572(73%) Female: 1,315 (27%)								
I.4.2	Number of people trained during IRS Training of Trainers	Project Training Records Annually	By Sex (# and %)	257	276 Male: 268 (97%) Female: 8 (3%)	320	292 Male: 281(96%) Female: 11(4%)								
I.4.3	Total number of	Project Records	By Sex (# and	4,528	4,366 ¹⁷	5,997	4,755 ¹⁸								

¹⁵ TOT (276), DEC's (49), Pesticide poison management (103), HEW (1,468), SQLs (393), SOPs (1,378), Porter (324), Washers (82), Drivers (129), Guards (81), Storekeepers (44) and Temporary Storekeepers (44).

¹⁶ TOT (292), DEC's (54), M&E Assistants (44), Pesticide poison management (79), Mobilizers (1,656), SQLs (644), SOPs (1,361), Porter (334), Washers (108), Drivers (145), Guards (87), Storekeepers (39) and Storekeeper assistants/pump technicians (44).

#	Performance Indicator	Data Source(s) and Reporting Frequency	Disaggregation(s)	Annual Targets and Results									
				Year 1		Year 2		Year 3		Year 4		Year 5	
				Target	Result	Target	Result	Target	Result	Target	Result	Target	Result
	people hired to support VC in target districts	Annually	%) Job Function VC Intervention Type		Male: 2,948(68%) Female: 1,418 (32%)		Male: 3,419(72%) Female: 1,336 (28%)						
I.4.4	Number of government/district officials who acted as supervisors during VC campaigns	Project Records Annually	Country VC Intervention Type	266	276 ¹⁹	294	292 ²⁰						
I.5	Promote gender equality in all facets of planning and implementation												
I.5.1	Number of women hired to support VC campaigns	Project Records Annually	Country Returning female seasonal workers hired in a more senior capacity	1,358	1,418 ²¹	2,099	1,336 ²²						
I.5.2	Number and percentage of women hired in supervisory roles in target areas for vector control activities	Project Records Annually	Country VC Intervention Type Job Function	63;	34 ²³ ; (5%)	99	98; (11%)						

¹⁷ Supervisors (276), DECs (44), Pesticide poison management (103), HEW (1,468), SQL (393), SOP (1,378), Porter (324), Washers (82), Drivers (129), Guards (81), Storekeepers (44) and Temporary Storekeepers (44).

¹⁸ Supervisors (292), DECs (45), M&E Assistants (44), Mobilizers (1,656), SQL (644), SOP (1,361), Porter (334), Washers (108), Water Fetchers(96),Guards (87), Storekeepers (44) and Storekeepers assistants/pump technicians (44).

¹⁹ MFPS- Regional, Zonal, and District (66), Environmental Compliance (42), Vice Heads (43), Information, Education and Communication (44) and Team Leaders (81)

²⁰ MFPS- Regional, Zonal, and District (67), Environmental Compliance (44), Vice Heads (44), Information, Education and Communication (44) and Team Leaders (93)

²¹ Supervisors (8); DECs (4); Pesticide poison management (13); HEWs (1,095); SQLs (24); SOPs (82); Porter (112); Washers (78); Storekeepers (1) and Temporary Storekeepers (1)

²² Supervisors (11); DECs (3); M&E Assistants(1);HEWs (859); SQLs (87); SOPs (49); Porter (175); Washers (108); Storekeepers (3);and Water Fetcher(40)

²³ In 2017, the community-based IRS approach was used in 5 districts and by design it involves women as SQLs since most SQLs are female HEWs. In 2018 district-based IRS was implemented which meant that SQLs were recruited from the general public and few women were interested in getting involved in IRS.

#	Performance Indicator	Data Source(s) and Reporting Frequency	Disaggregation(s)	Annual Targets and Results									
				Year 1		Year 2		Year 3		Year 4		Year 5	
				Target	Result	Target	Result	Target	Result	Target	Result	Target	Result
1.5.3	Number and percentage of staff (permanent and seasonal) who have completed gender awareness training	Project Training Records Annually	Country Sex Job Function	4,570 ²⁴	4,401 ²⁵ ; (96%) Male: 2,979 Female: 1,422	5,190 ²⁶	4,922 ²⁷ (95 %) Male: 3,602 Female: 1,320						
1.5.4	Number and percentage of women in senior leadership roles in VectorLink country offices	Project Records Annually	Country Sex (# and %)	N/A	N/A	N/A	N/A						
1.6	Implement and support social behavioral change communication and mobilization activities												
1.6.1	Number of radio spots and talk shows aired	Project Records Annually	Country VC Intervention Type	N/A	N/A	N/A	2 ²⁸						
1.6.2	Number of print materials disseminated	Project Records Annually	Country VC Intervention Type	5,817	6,561	8,630	7,550						
1.6.3	Number of people reached with vector control and/or SBCC messages via door-to-door messaging	Project Records Annually	Country VC Intervention Type Sex	N/A	N/A	1,496,124 ²⁹	844,917 ³⁰ Male: 414,726 Female: 430,191						

²⁴ 31 VectorLink staff, 257 supervisors, 60 DEC's, 132 Pesticide poison management, 1,615 HEW, 393 SQLs, 1,378 SOPs, 324 Porter, 82 Washers, 129 Drivers, 81 Guards, 44 Storekeepers and 44 Temporary Storekeepers.

²⁵ VectorLink staff (30), Supervisors (276), DEC's (49), Pesticide poison management (103), HEW (1,468), SQLs (393), SOPs (1,378), Porter (324), Washers (82), Drivers (129), Guards (81), Storekeepers (44) and Temporary Storekeepers (44).

²⁶ 31 VectorLink staff, 353 Supervisors, 692 SQLs, 1,413 SOP, 346 Porter, 100 Washers, 161 Drivers, 88 Guards, 88 Store, 60 DEC, 132 Pesticide poison Managements, 1,726 HEWS
²⁷ VectorLink staff (35), Supervisors (292), DEC's (54), M&E Assistants (44), Pesticide poison management (79), Mobilizers (1,656), SQLs (644), SOPs (1,361), Porter (334), Washers (108), Drivers (145), Guards (87), Storekeepers (39) and Storekeeper assistants/pump technicians (44).

²⁸ Radio spots were aired two times (1 before IRS and 1 during IRS) to mobilize the community in four different local languages

²⁹ Total target population

³⁰ Door to door mobilization in five Kamashi zone districts and Oda district weren't conducted due to security reasons.

#	Performance Indicator	Data Source(s) and Reporting Frequency	Disaggregation(s)	Annual Targets and Results									
				Year 1		Year 2		Year 3		Year 4		Year 5	
				Target	Result	Target	Result	Target	Result	Target	Result	Target	Result
1.6.4	Number and percentage of people who feel that the proposed action (sleeping under an ITN/accepting IRS) will reduce their risk of malaria	Project Records Annually	Country	N/A	N/A	N/A	N/A						
1.6.5	Number and percentage of people with a favorable attitude toward the practice/product (i.e., ITNs, IRS)	Project Records Annually	Country VC Intervention Type	N/A	N/A	N/A	N/A						
1.6.6	Number and percentage of people who believe that the majority of their friends and community members practice the behavior	Project Records Annually	Country VC Intervention Type	N/A	N/A	N/A	N/A						
1.7	Environmental compliance												
1.7.1	Number and percentage of SEAs (with EMMPs) or Letter Reports submitted at least 60 days prior to the commencement of vector control campaigns	Project Records Annually	Country	1; (100%)	1; (100%)	1; (100%)	1; (100%)						
1.7.2	Number and percentage of permanent and mobile soak pits (MSPs) inspected and approved prior	Project Records Annually	Country Soak Pit Type	115	110; (96%) 80 fixed soak pits; (94%) 30 MSPs;	110	133 (121%) 78 fixed soak pits; (98%)						

#	Performance Indicator	Data Source(s) and Reporting Frequency	Disaggregation(s)	Annual Targets and Results											
				Year 1		Year 2		Year 3		Year 4		Year 5			
				Target	Result	Target	Result	Target	Result	Target	Result	Target	Result		
	to IRS campaigns				(100%)										
1.7.3	Number and percentage of storehouses inspected and approved prior to IRS campaigns	Project Records Annually	Country Storehouse Type	46	46; (100%) 2 Central Warehouses 44 Store rooms	46;	46; (100%) 2 Central Warehouses 44 Store rooms								
1.7.4	Number and percentage of fixed soak pits that are compliant with PMI's Best Management Practices	Project Records Annually	Country	85	80 ³¹ ; (100%)	80	78 ³² ; (100%)								
2. Entomological and Epidemiological Data to Drive Decision-Making															
2.1	Vector control activities monitored via entomological and epidemiological data														
2.1.1	Number and percentage of project-supported entomological sentinel sites established to monitor vector bionomics and behavior (vector species, distribution,	Entomological Reports Annually	Country VC Intervention Type	3 ³³	3; (100%)	10 ³⁴	9; (90%)								

³¹ In 2018, the aim was to use 85 fixed soak pits but only 80 of the fixed soak pits were inspected and used.

³² In 2019, the aim was to use 80 fixed soak pits but only 78 of the fixed soak pits were inspected and used.

³³ The selected sites are: Abaya, Bambasi, and Lare.

³⁴ The selected sites are: Abaya, Bambasi, Lare, Diredawa, Kebridehe, Metema, and Benatsemay. The remaining 3 sites will be identified.

#	Performance Indicator	Data Source(s) and Reporting Frequency	Disaggregation(s)	Annual Targets and Results										
				Year 1		Year 2		Year 3		Year 4		Year 5		
				Target	Result	Target	Result	Target	Result	Target	Result	Target	Result	
	seasonality, feeding time, and location)													
2.1.2	Number and percentage of entomological monitoring sentinel sites measuring all five basic PMI entomological monitoring indicators (i.e., species composition, abundance, and seasonality of malaria vector; insecticide susceptibility and resistance intensity; mechanism of resistance; quality assurance and residual efficacy monitoring of IRS programs; or vector behavior: feeding time &, location)	Entomological Reports Annually	Country VC Intervention	13	13; (100%)	6 ³⁵	6; (100%)							
2.1.3	Number and percentage of entomological monitoring sentinel sites measuring at least one advanced	Entomological Reports Annually	Country VC Intervention	3 ³⁶	3; (100%)	6 ³⁷	9 ³⁸ ; (150%)							

³⁵ The number of IR monitoring sites increased from 13 to 30 based on the guidance from PMI including *An. stephensi*.

³⁶ The sites are: Abaya, Bambasi, and Lare.

³⁷ The selected sites are: Abaya, Bambasi, Lare, Diredawa, Kebrideher, and Benatsemay.

³⁸ Additional three sites were added: Abaya, Bambasi, Lare, Diredawa, Kebrideher, Benatsemay, Habru, Jabitehnan and Metema

#	Performance Indicator	Data Source(s) and Reporting Frequency	Disaggregation(s)	Annual Targets and Results											
				Year 1		Year 2		Year 3		Year 4		Year 5			
				Target	Result	Target	Result	Target	Result	Target	Result	Target	Result		
	PMI indicator (i.e., identification of mosquito infectivity; parity rates; or blood-meal analysis)														
2.1.4	Number and percentage of insecticide resistance testing sites that tested at least one insecticide from pyrethroid, organophosphate, carbamate, clothianidin, and chlorfenapyr insecticides	Entomological Reports Annually	Country Insecticide Type	4 ³⁹	4; (100%)	6 ⁴⁰	6; (100%)								
2.1.5	Number of wall bioassays conducted within 2 weeks of spraying to evaluate the quality of IRS	Entomological Reports Annually	Country	36 ⁴¹	48 ⁴²	48 ⁴³	36 ⁴⁴								
2.1.6	Number and percentage of cone bioassays conducted within two weeks of spraying with	Entomological Reports Annually	Country	48 ⁴⁵	48 ⁴⁶ ; (100%)	36 ⁴⁷	36 ⁴⁸ ; (100%)								

³⁹ The sites are: Abaya, Amibara, Halaba, and Ziway.

⁴⁰ The sites are: Abaya, Bambasi, Halaba, Abobo, Omonada, and Ziway.

⁴¹ 12 houses from 3 kebeles were planned for wall bioassays to be conducted within 2 weeks of spraying to evaluate the quality of IRS.

⁴² 12 houses from 4 kebeles were used for cone bioassays within 2 weeks of spraying to evaluate the quality of IRS.

⁴³ 12 houses from 4 kebeles will be used for cone bioassays within 2 weeks of spraying to evaluate the quality of IRS.

⁴⁴ 12 houses from 3 kebeles were used for cone bioassays within 2 weeks of spraying to evaluate the quality of IRS.

⁴⁵ 12 houses from 4 kebeles were planned for cone bioassays to be conducted within 2 weeks of spraying to evaluate the quality of IRS.

⁴⁶ 12 houses from 4 kebeles were used for cone bioassays within 2 weeks of spraying to evaluate the quality of IRS.

⁴⁷ 12 houses from 3 kebeles will be used for cone bioassays within 2 weeks of spraying to evaluate the quality of IRS.

⁴⁸ 12 houses from 3 kebeles were used for cone bioassays within 2 weeks of spraying to evaluate the quality of IRS.

#	Performance Indicator	Data Source(s) and Reporting Frequency	Disaggregation(s)	Annual Targets and Results										
				Year 1		Year 2		Year 3		Year 4		Year 5		
				Target	Result	Target	Result	Target	Result	Target	Result	Target	Result	
	greater than 98% test mortality recorded													
2.1.7	Number of wall bioassays conducted after the completion of spraying at monthly intervals to evaluate insecticide decay	Entomological Reports Annually	Country Insecticide Type	252 ⁴⁹	216	252 ⁵⁰	144 ⁵¹ Ongoing							
2.1.8	Number of vector susceptibility tests for different insecticides conducted in selected sentinel sites	Entomological Reports Annually	Country Insecticide Type	80 ⁵²	26 ⁵³	68 ⁵⁴	180 ⁵⁵							
2.1.9	Number of countries with an integrated vector control analytics dashboard available for decision making	Project Records Annually	Country	N/A	N/A	N/A	N/A							
2.1.10	Number of staff (VectorLink-contracted or non-	Project Training Records	Country Sex (# and %) Job Function	8	4 ⁵⁶ Male: 3 (75%)	20	23 ⁵⁷ Male: 20(87%)							

⁴⁹ 36 bioassays per month for 7 months were planned to be conducted in 3 kebeles.

⁵⁰ 36 bioassays per month for 7 months will be conducted in 3 kebeles.

⁵¹ Will continue up to two consecutive months below 80% mosquito mortality ,

⁵² 80 Tests: Permethrin=12, Propoxur=12, DDT=12, Bendiocarb=12, Deltamethrin=12, Pirimiphos-methyl=12, clothianidin=4, chlorfenapyr=4.

⁵³ Continued through October, 2018.

⁵⁴ 68 Tests: Permethrin=12, Propoxur=12, Bendiocarb=12, Deltamethrin=12, Pirimiphos-methyl=12, clothianidin=4, chlorfenapyr=4.

⁵⁵ 180 Tests: Permethrin=27, Propoxur=27, Bendiocarb=27, Deltamethrin=27, Pirimiphos-methyl=27, clothianidin=8, chlorfenapyr=10, Alphacypermethrin=27.

⁵⁶ Training was provided to two universities (Jigjiga, and Diredawa) and the Oromia Public Health Research Capacity Building and Quality Assurance Laboratory (Adama)- 2 Entomologists and 2 Ento Technicians.

⁵⁷ The training was provided to nine universities(Gondar-2, Jigjiga-1, Mekelle-1, Addis Ababa-3, Arba Minch-1, Debre-Markos-1, Diredawa-1, Assosa-1 and Jimma-2),EPI-3, AHRI-4, NMCP-1 and OPHRCBQAL-2

#	Performance Indicator	Data Source(s) and Reporting Frequency	Disaggregation(s)	Annual Targets and Results									
				Year 1		Year 2		Year 3		Year 4		Year 5	
				Target	Result	Target	Result	Target	Result	Target	Result	Target	Result
	VectorLink) trained in entomological monitoring	Annually			Female: 1 (25%)		Female: 3(13%)						
2.2	NMCPs develop country-level IRS and other malaria vector control strategies												
2.2.1	Number and percentage of countries with an integrated malaria vector control strategy, including a plan for monitoring and managing insecticide resistance supported by the project	Project Records Annually	Country	0	0	1	1						
2.2.2	Number and percentage of countries with integrated data and visualization landscaping for vector control decision making complete	Project Records Annually	Country	0	0	0	0						
2.2.3	Number and percentage of countries that implement sub-national insecticide as part of an IRM strategy	Project Records Annually	Country	0	0	0	0						
2.3	Build capacity of NMCPs and local institutions to collect, analyze, and use data for strategic malaria control decision-making												
2.3.1	Number of	Project Training	Country	TBD	0 ⁵⁸	0	0 ⁵⁹						

⁵⁸ This activity was not planned for 2018 since Ethiopia was not using DHIS2.

⁵⁹ This activity was not planned for 2019 since Ethiopia was not using DHIS2.

#	Performance Indicator	Data Source(s) and Reporting Frequency	Disaggregation(s)	Annual Targets and Results										
				Year 1		Year 2		Year 3		Year 4		Year 5		
				Target	Result	Target	Result	Target	Result	Target	Result	Target	Result	
	individuals trained from NMCPs and national institutions to review and interpret data for integrated vector control decision making	Records Annually	Job Function Organization											
2.3.2	Proportion of targeted individuals who report using new analytical tools and/or skills in their planning, resourcing, implementation, or measurement activities	Capacity Assessments Thrice Over Project Life	Country Job Function Organization	0	0	0	0							
3. Procure insecticides for IRS and support the delivery and storage of IRS and other malaria vector control products														
3.1	Cost-effective procurement mechanism established													
3.1.1	Number and percentage of insecticide procurements that had a pre-shipment QA/QC test at least 60 days prior to spray campaign	Procurement Records Annually	Country Insecticide Type	2	2; (100%)	1	1; (100%)							
3.1.2	Number and percentage of insecticide procurements received on-time to allow for the initiation of spray operations as scheduled	Procurement Records Annually	Country Insecticide Type	2	2; (100%)	1	1; (100%)							
3.1.3	Number and percentage of targeted countries	Procurement Records	Country VC Intervention Type	1	1; (100%)	1	1; (100%)							

#	Performance Indicator	Data Source(s) and Reporting Frequency	Disaggregation(s)	Annual Targets and Results										
				Year 1		Year 2		Year 3		Year 4		Year 5		
				Target	Result	Target	Result	Target	Result	Target	Result	Target	Result	
	with international equipment procurements, including PPE, received on-time to allow for the initiation of vector control campaigns as scheduled	Annually												
3.1.4	Number and percentage of targeted countries with local procurements for PPE received on-time to allow for the initiation of spray operations as scheduled	Procurement Records Annually	Country	1	1; (100%)	1	1; (100%)							
3.1.5	Number and percentage of countries with PPE procured according to workforce composition	Procurement Records Annually	Country	N/A	N/A	1; (100%)	1; (100%)							
3.2	Robust inventory management and logistics systems established													
3.2.1	Number and percentage of logistics and warehouse managers trained in vector control supply chain management	Project Training Records Annually	Country VC Intervention Type Sex	88 ⁶⁰	88; (100%) Male: 86 (98%) Female: 2 (2%)	88 ⁶¹	83, (94%) Male: 83 (100%) Female: 0(0%)							

⁶⁰ A total of 44 storekeepers and 44 temporary storekeepers.

⁶¹ A total of 44 storekeepers and 44 temporary storekeepers.

#	Performance Indicator	Data Source(s) and Reporting Frequency	Disaggregation(s)	Annual Targets and Results											
				Year 1		Year 2		Year 3		Year 4		Year 5			
				Target	Result	Target	Result	Target	Result	Target	Result	Target	Result		
3.2.2	Number and percentage of operations site warehouses where physical inventories can be verified by daily stock records	Inventory and Stock Records Annually	Country Insecticide Type	46	46; (100%) 2 Central houses 44 district store rooms	46	46; (100%) 2 Central houses 44 district store rooms								
3.2.3	Number and percentage of IRS countries that successfully completed spray operations without an insecticide stock-out	Inventory and Stock Records Annually	Country Insecticide Type	1	1; (100%)	1	1; (100%)								
4. Innovation															
4.1 Conduct operational research or monitoring to scale up new tools, methods, and approaches															
4.1.1	Number of operational research studies on promising new tools or new methods/approaches to existing tools that are implemented	Project Records Annually	Type of Innovation	TBD	0	1 ⁶²	0 ⁶³								
4.2 Create and share knowledge through dissemination of best practices and lessons learned															
4.2.1	Number of innovations, best practices, and other data or lessons learned shared with	Project Records Annually	Country Technical Area	TBD	0	1 ⁶⁴	1 ⁶⁵								

⁶² Evaluation of community perception and attitude towards plastering in sprayed houses

⁶³ The assessment is on progress.

⁶⁴ Recycling of uncontaminated cartons

⁶⁵ A short documentary on recycling of uncontaminated cartons; it is currently in the review process with the VectorLink HQ team and will be posted later.

#	Performance Indicator	Data Source(s) and Reporting Frequency	Disaggregation(s)	Annual Targets and Results										
				Year 1		Year 2		Year 3		Year 4		Year 5		
				Target	Result	Target	Result	Target	Result	Target	Result	Target	Result	
	other partners or international institutions for global reporting on the Vector Learning Exchange													
4.2.2	Number of individual members who use the Vector Learning Exchange	Project Records Annually	N/A	29	30	31	35							
4.2.3	Number of symposia and/or presentations submitted to and accepted at global conferences	Project Records Annually	Country Technical Area	TBD	0	1 ⁶⁶	0 ⁶⁷							
4.2.4	Number of success stories written or videos produced and shared on the VectorLink project website	Project Records Annually	Country	0	0	2	1							
4.2.5	Number of peer-reviewed journal articles submitted and accepted	Project Records Annually	Technical Area	1	0	2	0 ⁶⁸							
4.2.6	Number of critical guidance, standards, or plans that incorporate disseminated	Project Records Annually	Technical Area	1	1	1	1							

⁶⁶ Geographical distribution of *An. stephensi* in eastern Ethiopia.

⁶⁷ Five submitted and waiting for acceptance decision: Malaria Vectorial System and Insecticide Resistance in Ethiopia; The Distribution and Insecticide Resistance Status of *Anopheles Stephensi* in Eastern Ethiopia, Blood meal analysis of wild-caught *Anopheles stephensi* in Ethiopia, Molecular approaches to species and biological form identification of *Anopheles stephensi*, Genetic diversity of *Anopheles stephensi* in eastern Ethiopia

⁶⁸ Three are in the process of being submitted,

#	Performance Indicator	Data Source(s) and Reporting Frequency	Disaggregation(s)	Annual Targets and Results										
				Year 1		Year 2		Year 3		Year 4		Year 5		
				Target	Result	Target	Result	Target	Result	Target	Result	Target	Result	
	findings/best practices													
4.3	Develop and deploy cost-savings approaches													
4.3.1	Number of innovative or novel approaches implemented to achieve cost savings in IRS and integrated malaria vector control programs	Project Records Annually	Country VC Intervention Type	0	0	1	0							
4.3.2	Number of cost effectiveness assessments of existing approaches in the implementation of IRS and integrated malaria vector control programs	Project Records Annually	Country VC Intervention Type	0	0	0	0							
4.4	Cultivate public-private partnerships													
4.4.1	Number of private sector entities engaged with to establish public private partnerships to increase the quality and coverage of malaria vector control activities globally	Project Records Annually	Country Private Sector Organization	1	1 ⁶⁹	1	1 ⁷⁰							

⁶⁹ “Tewodros Fikru Rubber and Plastic Products Manufacturing Factory” is a privately owned company that recycles the empty insecticide bottles into electric conduits.

⁷⁰ “Tewodros Fikru Rubber and Plastic Products Manufacturing Factory” is a privately owned company that recycles the empty insecticide bottles into electric conduits.

ANNEX G: ENVIRONMENTAL MITIGATION AND MONITORING REPORT

Table G-1: Environmental Mitigation and Monitoring Report

Mitigation Measure	Status of Mitigation Measures	Outstanding Issues Relating to Required Conditions	Remarks
Ia. Pre-contract inspection and certification of vehicles used for pesticide or spray team transport.	Conducted between May 17 and June 16, 2019. In total, 150 vehicles were inspected and 145 were hired. The other five lacked complete documentation and their carrying capacity was less than recommended.	None	VectorLink Ethiopia used 2006 or newer model vehicles to transport spray teams. This made the project hire comfortable vehicles for spray teams.
Ib. Driver training	The 145 hired drivers were trained in Addis Ababa before they were dispatched to districts.	None	VectorLink oriented all drivers who joined the IRS campaign on the safeguards for Actellic 300CS and spray team transport.
Ic. Cell phone, personal protective equipment (PPE) and spill kits on board during pesticide transportation.	All drivers were required to have a cell phone and were given PPE after training. Transportation vendors provided each vehicle with a first aid box and spill management kit.	None	Vendors stocked all vehicles with complete spill kits and first aid kits to last the whole spray campaign after VectorLink staff emphasized this requirement for all vehicles.
Id. Initial and 30-day pregnancy testing for female candidates for jobs with potential pesticide contact.	SOPs, washers, and store assistants took initial pregnancy tests before they were hired. The tests were done a week before the start of IRS in each region. In districts where spraying lasted more than 30 days, a second test was conducted 30 days after the first tests and documented in the district.	None	No positive pregnancy test was recorded.
Ie. Health fitness testing for all operators	All SOPs received medical examinations (physical examinations, blood pressure) before they were hired.	-	-

Mitigation Measure	Status of Mitigation Measures	Outstanding Issues Relating to Required Conditions	Remarks
If. Procurement of, distribution to, and training on the use of PPE for all workers with potential pesticide contact.	Both international and local procurements were completed before trainings began. The use of PPE was demonstrated during TOTs, cascade, and storekeeper trainings, before the spray campaign began.		
Ig. Training on mixing pesticides and the proper use and maintenance of spray pumps.	All trainings covered the correct mixing procedure for pesticides, including triple rinse of the bottles. They also covered techniques on pump maintenance. The pump technicians were then trained on how to repair major defects.		Team leaders were available to assist pump technicians in the field to ensure that faulty pumps were immediately replaced or fixed. If the defect was major, the pump technician was called.
Ih. Provision of adequate facilities and supplies for end-of-day clean-up	VectorLink Ethiopia upgraded 64 temporary soak pits to permanent soak pits. In addition, 55 mobile soak pits (MSPs) were provided before the campaign. The VectorLink staff and district supervisors made sure that all operations sites were inspected and ready for the IRS operations.	VectorLink Ethiopia plans to renovate 16 soak pits that were not upgraded to permanent ones, to meet standards.	Some concrete wash pads had cracks as a result of inadequate curing time. The cracks were repaired prior to operations. In future, when building new wash areas, the concrete will be covered with sand and plastic, and watered daily for seven days to promote proper curing.
Ii. Enforce spray and clean-up procedures.	End-of-day clean-up was done in designated wash areas and supervised by the ECOs, VectorLink IRS coordinators, government district supervisors, and other VectorLink staff. PMI VectorLink staff and government supervisors inspected 78 sites and a total of 824 inspections were submitted. There were 9 red flags regarding end-of-day clean-up and all were immediately resolved.	None	Early in the campaign, team leaders did not take time to supervise the end-of-day clean-up activities. PMI VectorLink staff who visited all districts addressed the issue by providing feedback and disseminating SMS and email reminders. Observed cases of non-compliance were resolved immediately on the spot.
2a. IEC campaigns to inform homeowners of responsibilities and precautions.	The project trained 1,656 (859 female, 797 male) community mobilizers to conduct door-to-door community mobilization and sensitization on IRS to inform homeowners what to do before, during, and after spraying.	None	Community mobilization was done two weeks before spraying began, and feedback or a mobilization report was presented prior to campaign launch. The mobilization report helped organize the spray schedule.

Mitigation Measure	Status of Mitigation Measures	Outstanding Issues Relating to Required Conditions	Remarks
2b. Prohibition of spraying houses that are not properly prepared.	SOPs were advised not to spray in structures that were not properly prepared. PMI VectorLink staff conducted 4,956 homeowner preparation and SOP performance inspections; they observed 25 incidents early in the campaign.	None	Early in the IRS campaign, household preparation was inadequate in some districts. In most cases, huge stacks of grains were not removed. The IRS operation in the affected districts was stopped, spray teams were re-trained, and the community was mobilized again. In all cases, the household preparations improved.
2c. Two-hour exclusion from house after spraying	SOPs were trained to tell homeowners to keep windows and doors of sprayed structures closed for two hours, and then to open them to circulate air for at least 30 minutes before cleaning floors. The ECO, zonal IRS coordinators, and district supervisors played a pivotal role in enforcing this requirement. As a result, all inspections revealed SOPs had informed household owners about post-spray procedures.	None	None
2d. Instruct homeowners to wash itchy skin and go to health clinic if symptoms do not subside.	Homeowners were instructed to wash their skin with plenty of water and soap if they experienced itching and to visit the nearest clinic if the itching persisted. Out of the 4,956 submissions done, only 9 were found that homeowners were not informed about this requirement.	None	Most SOPs provided the required information to homeowners, but some homeowners forgot the instructions. However, these instructions were repeated by PMI VectorLink staff and RHB staff doing monitoring and supervision
3a. Indoor spraying only	The ECO, zonal IRS coordinators, team leaders, and supervisors worked hard to ensure all sprayable surfaces were sprayed, including the walls, ceiling, and eaves of all sleeping spaces. Out of 4,956 inspections by the team, 10 were found to have sprayed inappropriate surfaces (floors, metal roof, outside surface of door, glass).	None	This was immediately resolved and communicated during morning mobilization.

Mitigation Measure	Status of Mitigation Measures	Outstanding Issues Relating to Required Conditions	Remarks
3b. Training on proper spray technique	SOPs were trained on proper spray techniques during cascade trainings. The 4,956 inspections by the supervisors found only 26 instances of SOP non-compliance.	None	During the first week of spraying, SOPs who were new hires were not consistent with the spray techniques, but improved after a few days of the campaign with supervision. As the campaign progressed, spray technique was no longer an issue.
3c. Maintenance of pumps	Prior to the deployment of SOPs each morning, team leaders and supervisors serviced all spray pumps. Out of 4,956 inspections done by supervisors, 22 leaking pumps were found. However, the pump technician, team leaders, and supervisors were always in the field to repair the defective pumps so that SOPs could quickly resume work.	None	
4a. Choose sites for disposal of liquid wastes according to PMI BMPs.	Selecting the soak pit sites for liquid waste disposal was jointly done by the ECO, VectorLink supervisors, and district supervisors and was supervised by the project COP in accordance with the PMI BMP. In total, 78 fixed soak pits and 55 MSPs were used during the 2019 IRS campaign. Inspections of MSP sites reported no badly selected MSP sites, nor did the PSECA.	None	All sites selected for both fixed and mobile soak pits were suitable for the disposal of liquid waste.
4b. Construct soak pits with charcoal to adsorb pesticide from rinse water.	Two new soak pits were constructed according to BMP design. Construction was supervised by the ECO, zonal IRS coordinators, and district supervisors. In total, 55 MSPs filled with granulated activate charcoal (GAC) were used in 12 districts where SOPs camped.	None	The use of MSPs reduced the costs and compliance issues associated with long distances between the fixed IRS operations site and spray sites. MSPs also expedited end-of-day clean-up. At the fixed soak pits, end-of-day clean-up was expedited by setting two sets of seven rinse barrels each, to avoid congestion at the soak pit
4c. Maintain soak pits as necessary during season.	78 fixed and 55 mobile soak pits were well maintained. Contaminated water drained properly into the soak pits.	None	

Mitigation Measure	Status of Mitigation Measures	Outstanding Issues Relating to Required Conditions	Remarks
4d. Inspection and certification of solid waste disposal sites before spray campaign.	VectorLink Ethiopia, with support from Ethiopia's Environmental Protection Authority, ensured that the sites for waste disposal were inspected to meet the standards. VectorLink Ethiopia will use the authority-approved incinerator to incinerate nose masks and contaminated cardboard boxes. Uncontaminated cardboard boxes will be recycled at the Ethiopian Pulp and Paper Production Company. Empty Actellic bottles and plastic sheets will be recycled in Addis Ababa at Tewodros Fikru Plastic and Plastic Products Manufacturing Company.	Collection of all contaminated and non-contaminated cardboards, empty bottles, and nose masks is in progress from the PMI target districts to Addis Ababa.	
4e. Monitoring waste storage and management during campaign.	All IRS solid waste was separated into categories (paper, plastic, rubber, and cloth, and stored in labeled bags. Out of the 430 storekeeper performance inspections that were conducted, only 8 were red flags.	None	Most storekeepers were not new to the project, which made it easier for them to adhere to the PMI BMP guidelines. Additionally, the entire VectorLink Ethiopia senior management team was in the field supervising IRS operations throughout the campaign and was able to immediately identify and correct many non-compliance issues.
4f. Monitoring disposal procedures post-campaign.	The ECO will monitor the post-spray campaign solid waste disposal. All IRS waste has already been collected and transported to Addis Ababa and will be incinerated or recycled as per PMI BMP guidelines.	None	
5a. Maintain records of all pesticide receipts, issuance, and return of empty sachets/bottles.	Stock cards tracked pesticide going to and from the central store, with back-up ledger books at central, district, and sub-district stores. The 63 storekeeper performance inspections conducted found 1 stock card where the end-of-day balance of empty bottles did not equal the opening balance in the ledger.	None	Most storekeepers had worked for previous IRS campaign/s and adhered closely to the PMI BMP guidelines. VectorLink Ethiopia staff were in the field to monitor and supervise IRS operations throughout the campaign; this limited environmental compliance violations in IRS stock management. Issues identified were rectified immediately.

Mitigation Measure	Status of Mitigation Measures	Outstanding Issues Relating to Required Conditions	Remarks
5b. Reconciliation of number of houses sprayed vs. number of sachets/bottles used.	The average number of structures sprayed per bottle of insecticide was 4, slightly higher than the estimated average of 3.64.	None	There was a slight difference between the estimated and the actual insecticide burn rates. This was mostly because the majority of structures excluded were larger urban ones, leaving a greater percentage of smaller rural ones.
5c. Visual examination of houses sprayed to confirm pesticide application.	Visual examination of houses sprayed was conducted by observing the traces of the sprayed chemical of the walls, ceilings, and eaves during DCV by all supervisors and M&E assistants.	None	
5d. Perform physical inventory counts during the spray season.	The ECO, zonal IRS coordinators, and logistics coordinator conducted physical inventory counts during and after the spray season using the storekeeper performance inspection checklist. Out of the 430 inspections, only 8 did not have a balance between the stock cards and the physical stock.	None	Most storekeepers were not new to the project. Therefore, they were able to correctly use stock control cards and daily insecticide usage registers, and they made no errors in entries.