



U.S. PRESIDENT'S MALARIA INITIATIVE



PMI VECTORLINK GHANA END OF SPRAY REPORT

SPRAY CAMPAIGN: APRIL 2–MAY 9, 2019

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Abt Associates Inc. | 6130 Executive Boulevard | Rockville, MD 20852
T. 301.347.5000 | F. 301.913.9061 | www.abtassociates.com

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ACRONYMS

Actellic	Actellic® 300CS
AGAMal	AngloGold Ashanti Ghana Malaria Control, Ltd.
AIRS	Africa Indoor Residual Spraying (project)
BND	Bunkpurugu-Nakpanduri District
CHD	Chereponi District
CHN	Community Health Nurse
COP	Chief of Party
DCV	Data Collection Verification
DEA	Data Entry Assistant
DEHO	District Environmental Health Officer
DOC	District Operations Coordinator
DOS	Directly Observed Spraying
EC	Environmental Compliance
ECO	Environmental Compliance Officer
EMD	East Mamprusi District
EPA	Environmental Protection Agency
FS	Field Supervisor
GAC	Granulated Activated Carbon
GHS	Ghana Health Service
HPO	Health Promotion Officer
GUD	Gushegu District
IRS	Indoor Residual Spraying
KAD	Karaga District
KUD	Kumbungu District
M&E	Monitoring and Evaluation

MaVCOC	Malaria Vector Control Oversight Committee
MMD	Mamprugu Moaduri District
MSP	Mobile Soak Pit
NIRMOP	National Insecticide Resistance Monitoring Partnership
NMCP	National Malaria Control Program
NMIMR	Noguchi Memorial Institute for Medical Research
ODK	Open Data Kit
PMI	U.S. President’s Malaria Initiative
PMT	Performance Monitoring Tracker
PPE	Personal Protective Equipment
PSECA	Pre-Season Environmental Compliance Assessment
SBC	Social and Behavior Change
SOP	Spray Operator
SS	SumiShield® 50WG
TL	Team Leader
TOT	Training of Trainers
USAID	United States Agency for International Development
VL	VectorLink
WHO	World Health Organization
WMD	West Mamprusi District
YND	Yunyoo-Nasuan District

EXECUTIVE SUMMARY

In 2019, PMI VectorLink (VL) Ghana implemented a 30-operational day (April 2 through May 9) IRS campaign in eight districts in northern Ghana: Bunkpurugu-Nakpanduri (BND), East Mamprusi (EMD), Gushegu (GUD), Karaga (KAD), Kumbungu (KUD), Mamprugu Moaduri (MMD), West Mamprusi (WMD), and Yunyoo-Nasuan (YND) districts. In addition to the initially planned spray campaign, VL Ghana conducted a six-operational day (May 16 through 26) partial spraying trial in three communities in BND, GUD, and KD. The objective of the field-based trial was to monitor the efficacy of IRS on reduced amounts of surfaces and assess potential cost savings and operational benefits of this approach. The planned expansion of IRS to a ninth district, Chereponi, did not happen due to tribal feuds causing safety and security challenges. VL Ghana recruited 2,594 seasonal employees for the campaign. Table ES-1 presents summary results of the 2019 spray campaign.

TABLE ES-1. 2019 VL GHANA IRS SUMMARY

Number of districts covered by IRS in 2019	8 districts: BND, EMD, GUD, KAD, KUD, MMD, WMD, and YND
Insecticide used in 2019 IRS	Organophosphate (Actellic® 300CS, 5 districts) and neonicotinoid (SumiShield® 50WG, 3 districts)
Structures targeted for spray in 2019 (structures found by spray operators in 2018)	324,704
Structures found by spray operators in 2019	316,285
Structures sprayed in 2019	298,385
Spray coverage	94.3%
Population protected	875,481 (including 19,844 pregnant women and 157,398 children under 5 years)
Dates of IRS campaign	April 2–May 9, 2019; May 16–26, 2019
Length of IRS campaign	30 operational days (original spray campaign) 6 operational days (partial spray pilot)
Number of people trained with funds from the US Government to deliver IRS in 2019*	864 (676 men, 188 women)

* This figure includes only spray personnel such as spray operators, team leaders and field supervisors.

The 2019 spray campaign coverage exceeded the PMI contractual and the National Malaria Control Program (NMCP) required coverage targets of 85 percent and 90 percent, respectively, and surpassed 92 percent coverage achieved in 2018. Spray quality results demonstrated 100 percent mosquito mortality across all districts for the two insecticides used: pirimiphos-methyl (Actellic® 300CS) and clothianidin (SumiShield® 50WG).

As in 2018, the project worked to resolve challenges that included delayed household preparation, locked structures, and refusals. In shea nut communities (two in KAD and two in GUD), refusals were due to misinformation spread last year by shea nut exporting companies about IRS and its effects on organic shea nuts. The VL Ghana team, together with Ghana Health Service and District Assembly representatives, held special meetings with the communities to correct the misinformation resulting in all four communities being sprayed with high IRS acceptance.

In October 2018, as preparations for the 2019 IRS campaign began, the project held an eight-day IRS boot camp for government officials, VL Ghana staff, and the other IRS implementer in Ghana, AngloGold Ashanti Ghana Malaria Control Ltd.

I. COUNTRY BACKGROUND

The U.S. President's Malaria Initiative (PMI) has supported indoor residual spraying (IRS) in Ghana since 2008. PMI's 2015-2020 goals are to reduce malaria mortality by one-third from 2015 levels in PMI-supported countries, achieving a greater than 80 percent reduction from PMI's original 2000 baseline levels; reduce malaria morbidity in PMI-supported countries by 40 percent from 2015 levels; and assist at least five PMI-supported countries to meet World Health Organization criteria for national or sub-national pre-elimination.

In October 2017, Abt Associates was awarded a five-year follow-on to the Africa IRS (AIRS) project. The PMI VectorLink project continues to implement IRS and enhanced entomological monitoring in up to 23 African countries, including Ghana

Indoor residual spraying (IRS) is a major part of Ghana's malaria control strategy. The country's National Strategic Plan for Malaria Control (2014-2020) seeks to protect at least 80 percent of the population at risk of contracting malaria by 2020 using universal coverage of insecticide-treated nets, IRS in areas of high parasite prevalence, seasonal malaria chemoprevention, larviciding, and prevention of malaria in pregnancy. Since 2008, PMI has supported the National Malaria Control Program's (NMCP's) goal of reducing the burden of malaria by funding IRS in the Northern Region. The PMI-funded VL Ghana project now serves two administrative regions following the referendum on the creation of six new regions in Ghana: it now operates in five districts in the North East Region and three districts in the Northern region. Specifically, the districts are as follows: in the North East Region, Bunkpurugu-Nakpanduri (BND), East Mamprusi (EMD), Mamprugu Moaduri (MMD), West Mamprusi (WMD), and Yunyoo-Nasuan (YND); in the Northern Region, Gushegu (GUD), Karaga (KAD), and Kumbungu (KUD). Planned expansion of IRS to a ninth Northern Region district, Chereponi (CHD), was not possible this year due to tribal feuds causing safety and security challenges.

I.1 2019 IRS AND OTHER OBJECTIVES

In the 2019 spray campaign, VL Ghana worked in partnership with the Ghana Health Service (GHS), District Assemblies, and the NMCP to conduct IRS operations. The target for the original nine districts was to spray over 300,000 structures and protect over 900,000 people. With CHD removed from the spray plan, the population target was revised to 850,000.

Ghana's key objectives were:

- To achieve at least 85 or 90 percent spray coverage of eligible structures in the targeted districts in accordance with the PMI contractual and NMCP targets, respectively.
- To continue building capacity at all levels of the health system to ensure the proper implementation of IRS and the sustainability of IRS operations.
- To continue financial and technical support to the Noguchi Memorial Institute for Medical Research (NMIMR) in collecting insecticide resistance data at 10 sentinel sites as part of the National Insecticide Resistance Monitoring Partnership (NIRMOP) and laboratory analyses of entomological specimens for both NIRMOP (the 10 sites supported by Global Fund) and the project entomological monitoring data.
- To fund and provide technical assistance and management oversight to the NMCP's Malaria Vector Control Oversight Committee (MaVCOC).
- To coordinate two operational research activities:
 - (1) Study One: Conducted a small-scale pilot in a real-life setting to evaluate pirimiphos-methyl efficacy when sprayed on half the usual surface area against wild populations of *Anopheles gambiae*.

- (2) Study Two: Documenting results of the study on “Effect of IRS on *Anopheles* vector behaviors and their impact on malaria transmission in the Northern region of Ghana” for which data collection ended in April 2019?

I.2 ACHIEVEMENTS OF 2019 IRS CAMPAIGN

VL Ghana’s 2019 IRS operations achieved the following specific results:

- Successfully launched 2019 spray campaign on April 2 as scheduled.
- Reached an overall spray coverage of 94.3%, with all eight districts performing above the PMI (85%) and NMCP (90%) spray coverage targets.
- Protected a total population of 875,481, including 157,398 children under five years and 19,844 pregnant women.
- According to spray quality results, demonstrated 100 percent mosquito mortality at 1-3 days after spraying in all districts for both insecticides (pirimiphos-methyl and clothianidin).
- Completed a pilot of partial spraying with pirimiphos-methyl in three communities.
- Increased female participation in all staff categories by 23.4%. In 2019, out of all the seasonal workers hired, VL hired 469 females up from 380 in 2018.

During the spray campaign, VL Ghana hosted staff from the USAID Environmental Compliance Support (ECOS) project who conducted an environmental compliance field evaluation for IRS operations in PMI-supported spray districts. Representatives from USAID/PMI Ghana, NMCP, and the USAID Global Health Bureau also participated, namely: Dennis Durbin, the Global Health Bureau Environmental Officer at USAID/Washington; Eric Tongren, PMI Resident Advisor; Dominic Dery, Project Management Specialist at USAID Ghana; Christian Atta Obeng and James Frimpong from NMCP; and Brad Longman, VL Vector Control Manager. As part of IRS orientation, the incoming VL Mali Chief of Party (COP), Dr. Desire Boko, observed and participated as supervisor in IRS operations during a four-day visit.

Also, in October 2018, USAID Administrator Mark Green visited the VL Ghana office in Tamale, where he had a discussion with the project team and invited district partners, and observed mosquito identification dissections in the project’s entomological laboratory. His visit greatly increased the morale of the team ahead of the intense pre-spray preparation period.

From May 2018 through May 2019, VL Ghana hosted a Peace Corp Volunteer. Although she did not directly participate in the IRS campaign, she worked with the entomological team to organize the field data and analyze qualitative information gathered for the vector outdoor behavior study, one of the two operational research activities that VL Ghana is finishing in 2019.

2. PRE-SPRAY ACTIVITIES

2.1 INSECTICIDE SELECTION

As in previous years, VL Ghana presented to MaVCOC the results from the insecticide susceptibility and residual efficacy tests conducted in 2018, to inform the committee's selection of insecticide for the 2019 campaign. The results indicated that the mosquito vectors were susceptible to clothianidin and pirimiphos-methyl, the active ingredients of SumiShield® 50WG (SS) and Actellic® 300CS (Actellic), respectively. The MaVCOC members agreed to introduce clothianidin as part of an insecticide resistance management (rotation) strategy in some of the districts that had sprayed pirimiphos-methyl for over six years. In addition to MMD, where the project had sprayed clothianidin in 2018, VL Ghana earmarked three districts (CHD, EMD, and WMD) as those that would use clothianidin in 2019; they were selected because of increased refusals of Actellic due to its smell in 2018. The other five districts (BND, GUD, KAD, KUD, YND) would continue spraying pirimiphos-methyl because the vectors were still highly susceptible to the insecticide.

2.2 MICROPLANNING

To effectively implement a successful IRS operation and improve stakeholder participation, VL Ghana conducted microplanning meetings with stakeholders at the community, district, and regional level prior to the spray campaign. Representatives from the GHS Regional and District Health Directorates, District Assemblies, and some paramount community chiefs attended the meetings. The meetings strengthened project relations with stakeholders, increased local participation in the IRS campaign, and brought operational issues for consideration. Topics discussed at the meetings centered on:

- Recruitment of spray operators (SOPs) and team leaders (TLs).
- Support required from the regional GHS to conduct medical exams for SOPs and TLs.
- Start date and duration of the campaign
- Social and behavior change (SBC) communication plans and strategies.
- Common misconceptions about IRS (e.g., some communities in MMD believe insecticide increase pests among poultry).

Together with the information and health promotion officers (HPOs) of the GHS regional directorate, VL Ghana developed a communication and mobilization plan and supervision schedule.

2.3 EXPANSION OF IRS INTO CHEREPONI DISTRICT

After the 2018 spray campaign, the project identified sufficient resources to scale up IRS to an additional small district in 2019. After detailed analysis and consultations with PMI and NMCP, the project selected CHD as that district. A high malaria test positivity rate (69.1%) as reported by GHS and high IRS acceptance in 2012 were the main factors for the selection, as well as CHD's proximity to other PMI VectorLink Ghana districts in the Northern Region.

VL Ghana completed the majority of IRS ground work to prepare CHD for the 2019 campaign, including conducting door-to-door enumeration and mobilization to obtain exact data for structures to spray (29,814). Only recruitment and training seasonal personal remained to be completed when the project decided not to spray in CHD due to the emergence of ethnic conflict that would have threatened the safety and security of project staff.

The conflict started as a one-off clash in December 2018 but continued with the burning of multiple communities and flight of residents who sought refuge in neighboring districts and some communities bordering Togo. When the situation became acute about three weeks before the start of spraying, VL Ghana suspended all pre-spray planning activities, evacuated all project employees from the district, and moved out equipment and supplies. The project team continues to monitor the security situation in CHD and collect data on other districts to potentially pursue IRS expansion in 2020 if the security situation in CHD does not improve over the course of the year.

2.4 LOGISTICAL NEEDS ASSESSMENT

The project conducted a logistical needs assessment to verify operations sites and finalize quantities of supplies and materials to be procured for the 2019 campaign. As part of the process, VL Ghana visited all proposed operations sites and the central medical store.

The project team quantified IRS supplies and materials based on the number of structures found in the 2018 IRS campaign, number of operational days, and the number of SOPs and other support staff to be hired. Using the assessment results, VL Ghana developed a logistics distribution plan, established recruitment needs, and made procurement decisions.

Out of 24 permanent operations sites, government stakeholders provided 22 sites as part of their in-kind contribution. The project rented from private individuals facilities such as offices and stores in the remaining two sites (Kumbungu and Dalun sites in KUD). With the help of the community, which provided land and some labor, the project refurbished the Kpatinga permanent site (GUD). The project rented for a few months two data centers (in GUD and BND). Community chiefs provided storage space for two mobile soak pit (MSP) sites (in Nasia (WMD) and Kunkua (MMD)), while the Presbyterian Church provided a space for a large warehouse in Langbensi (EMD).

2.5 PROCUREMENT

VL Ghana distinguishes local and international procurement of commodities to ensure cost effectiveness and timely delivery of materials. VL Ghana conducted local procurement for all IRS consumables and several reusable items such as aprons and SOP bags. The team completed most local procurement by March 2019. This timeline provided a buffer period of almost one month to complete final purchases before the start of spray operations.

International procurements were mainly the purchase of insecticides, spray pumps and accessories, and key personal protective equipment (PPE). VL Ghana purchased 103 Goizper pumps (for CHD and to replace unserviceable Hudson pumps as the project fully transitioned to the Goizper pumps). Internationally procured PPE items included coveralls, hand gloves, nose masks, boots, and hard hats.

Based on insecticide usage in 2018, with the ratio of 4.6 structures per bottle/sachet, VL Ghana calculated the total need for 76,598 bottles/sachets of insecticide (37,930 of Actellic and 38,668 of SS) to cover targeted structures inclusive of CHD. With 11,100 bottles of Actellic and 376 sachets of SS remaining from the 2018 campaign, VL Ghana procured 26,830 bottles¹ of Actellic and 38,292 sachets of SS. The procured insecticide received the UNTAID co-payment through the Next Generation IRS project. By March 2019, all insecticides were in the project's rented warehouses, since the central medical store used in prior years was under renovation.

VL Ghana distributed all items to the operations sites two weeks before the spray campaign began, with the exception of the insecticides, which were delivered one week before the campaign began. Annex A lists the post-spray balance of main materials and supplies procured for the 2019 campaign.

¹ VL Ghana ordered 26,830 bottles of Actellic but received 26,832 bottles. We received two extra bottles for free.

2.6 TRAINING

IRS application is highly technical and demands rigorous and comprehensive training of personnel to ensure correct application on the walls and the intended sustained impact. VL Ghana trained all seasonal staff prior to the implementation of the 2019 spray campaign, in trainings on nine aspects of IRS implementation, as listed in Table 1.

VL Ghana included field simulation sessions in the Training of Trainers (TOT) and SOP and TL training. The purpose of these sessions is to expose spray teams to real-life situations they are likely to encounter during the spray campaign. During the sessions, trainees visited nearby houses to practice the spray techniques, data collection, household preparation, and SBC messages.

In BND, GUD, and KUD, where the project piloted partial spraying, the project conducted a one-day refresher training on partial spray techniques for the spray teams.

TABLE 1. 2019 VL GHANA TRAINING PROGRAMS

Type of Training	Dates	Length (days)	Location	Training Topics
SBC TOT	January 21-23	3	Tamale	Community mobilization strategies, including sensitization, structure identification, and household mobilization data collection. Training techniques for mobilizer training.
Mobilizer Training	March 18-21	4	All 24 operations sites	Community sensitization and household preparation.
Logistics and Store Management	February 25-27	3	Tamale	Record and stock keeping of all inventories.
Spray Operations TOT for Supervisors, Site Managers	February 25-March 1; March 4-8	5	Walewale	Spraying techniques, EC compliance, data capture, gender sensitization, supervisory tools including use of smart phones.
IRS Orientation for Community Health Nurses	March 7	1	Tamale	Mobilization and IRS operations.
IRS Training for SOPs and TLs	March 18-23	6	All 24 operations sites	Spraying techniques, household preparations, EC compliance, and data capture.
M&E and Data Entry Training for M&E, Data Entry, and DCV Assistants	February 18-20	3	Tamale	Introduction to data entry protocols, use of the 2018 database for mobilization, spray data entry, data cleaning, storage, and security, and M&E tools.
IRS Training for Media Personnel	March 8	1	6 radio stations in IRS districts	Dissemination of IRS messages to community and how to encourage IRS acceptance
Finance Training for Finance Assistants	February 28-March 1	2	Tamale	Proper record keeping, petty cash handling, timesheet recording, and other financial management topics.

Note: EC=environmental compliance, M&E=monitoring and evaluation, DCV=data collection verification

During the final pre-spray inspection visit, the project's environmental compliance officer (ECO) conducted on-the-job orientations for guards and other staff on emergency situation and security.

As shown in Table 2, the project trained a total of 2,289 people (1,887 males, 402 females). The table also includes trainees who qualify under the PMI indicator definition "number of people trained with USG [U.S. Government] funds to deliver IRS." In 2019, VL Ghana trained 864 people (676 men and 188 women) to deliver IRS under this definition (Indicator 1.4.1 of VL Ghana indicator matrix).

TABLE 2. PEOPLE TRAINED, 2019

Categories of Persons Trained	Training on IRS Delivery										Other Trainings								TOTAL		
	Training of Trainers: Spray Ops		Spray Operations		M&E and Data Entry		Logistics & Store management		SBC Training		IRS for Media Personnel		IRS for Nurses		Mobilizer Training		Finance Training				
	M	F	M	F	M	F	M	F	M	F	M	F	M	F	M	F	M	F	M	F	TOTAL
District Operations Coordinators	0	1																	0	1	1
Disease Control Officers	9	0																	9	0	9
District Environmental Health Officers	8	1																	8	1	9
District Information Officers					2	1													2	1	3
Health Promotion Officers									8	1									8	1	9
District Supply Officers							8	0											8	0	8
Spray Operators			514	153															514	153	667
Team Leaders			110	30															110	30	140
Data Entry Assistants					28	10													28	10	38
M&E Assistants					8	2													8	2	10
DCV Assistants					7	2													7	2	9
Logistics Assistants							7	1											7	1	8
Store Assistants							5	23											5	23	28
SBC Assistants									22	4									22	4	26
Mobilizers															1,040	129			1,040	129	1,169
Field Supervisors	52	5																	52	5	57
Site Managers	19	8																	19	8	27
Finance Assistants																	4	4	4	4	8
Media Personnel											12	0							12	0	12
Community Health Nurses													24	27					24	27	51
TOTAL M/F	88	15	624	183	45	15	20	24	30	5	12	0	24	27	1,040	129	4	4	1,887	402	2,289
TOTAL/ training	103		807		60		44		35		12		51		1,169		8		2,289		

2.7 RECRUITMENT

IRS project staffing comprises two categories of personnel: district-level staff (SBC assistants, logistics assistants, M&E assistants, site managers, store assistants, washers, water fetchers, and security guards) and field staff (field supervisors [FS], TLs, and SOPs). VL Ghana also engaged packers on an as-needed basis to assist with household preparation. VL Ghana advertised job openings for all “assistant,” FS, and spray operations data coordinator positions in a national daily newspaper and through the jobsinghana.com online platform. The project advertised TL, SOP, washer, water fetcher, and security guard jobs on posters at each operations site, and in District Assemblies and GHS offices. For each position, the project used a set of selection requirements. Applicants were qualified for hire based on their meeting the requirements and satisfactory performance during an interview.

Requirements for TLs and SOPs included a literacy (written) test, face-to-face interview, medical screening (and pregnancy test for female candidates), and submission of mobile phone numbers and signatures of two persons qualified as guarantors for surety of good behavior. All successful applicants were invited for training. However, the final selection and recruitment for IRS happened after assessing the level of commitment and acquired skills each applicant demonstrated during the training.

In 2019, to improve TL performance and supervisory capacity, VL Ghana began recruiting TLs separately from SOPs using more comprehensive selection criteria. The TLs were identified at the onset of the SOP and TL training so all SOPs would know from the start who would be a TL. The project also significantly enhanced the curriculum for a separate one-day training of TLs (adjunct to the SOP and TL training) on TL leadership and accountability.

2.8 NUMBER OF PEOPLE HIRED

In the 2019 spray campaign, PMI VectorLink VL Ghana engaged a total of 2,594 as seasonal staff, 18.1% of whom were females. Table 3 provides a breakdown of the different categories of personnel hired to carry out and support IRS operations. Excluding packers, who were not trained for IRS and hired for only a few days, VL Ghana employed 2,394 seasonal workers.

TABLE 3. PEOPLE HIRED, 2019

Categories of Persons Hired	BND		EMD		GUD		KAD		KUD		MMD		WMD		YND		Tamale		All			% Female
	M	F	M	F	M	F	M	F	M	F	M	F	M	F	M	F	M	F	M	F	Total	
DOC	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1			0	1	1	100.0%
Data Entry Assistants	4	1	6	0	4	0	3	1	0	4	4	0	5	2	0	0			26	8	34	23.5%
Finance Assistants	1	0	1	0	0	1	0	1	0	1	0	1	0	0	0	0	1	0	4	4	8	50.0%
SBC Assistants	3	0	3	2	4	0	3	1	1	1	2	0	3	1	2	0			21	5	26	19.2%
Logistics Assistants	1	0	1	0	1	0	1	0	0	1	1	0	1	0	0	0	1	0	7	1	8	12.5%
Store Assistants	1	2	1	4	1	2	1	2	0	2	0	2	1	3	0	2	0	1	5	20	25	80.0%
Mobilizers	152	12	174	27	206	16	144	24	143	5	42	5	109	38	70	2			1040	129	1,169	11.0%
Security officers	6	0	11	0	8	0	6	0	4	0	5	0	6	0	4	0			50	0	50	0.0%
Site Managers	3	0	4	1	3	1	2	1	1	1	1	1	2	1	1	1			17	7	24	29.2%
Spray Operators	65	15	99	42	66	28	60	11	54	15	34	10	90	19	25	4			493	144	637	22.6%
Supervisors	5	0	8	2	6	0	5	0	6	0	4	1	9	2	2	0			45	5	50	10.0%
Team Leaders	11	4	21	7	14	5	12	1	12	2	8	1	13	9	2	4			93	33	126	26.2%
Washers	0	10	0	14	1	9	0	8	0	5	0	5	0	10	0	4			1	65	66	98.5%
Water Fetchers	1	0	1	0	1	0	0	0	0	0	2	0	0	4	2	0			7	4	11	36.4%
M&E Assistants	0	1	1	0	1	0	1	0	0	1	1	0	1	0	0	0			5	2	7	28.6%
DCV Assistants	1	0	1	0	1	0	1	0	1	0	1	0	1	0	1	0			8	0	8	0.0%
Packers	40	0	16	17	14	10	10	0	52	4	24	0	12	1	0	0			168	32	200	16.0%
Entomology																	135	9	135	9	144	6.3%
Total M/F	294	45	348	116	331	72	249	50	274	42	129	26	254	90	109	18	137	10	2,125	469	2,594	18.1%
Grand Total	339		464		403		299		316		155		344		127		147		2,594			

3. IMPLEMENTATION OF IRS ACTIVITIES

3.1 SPRAY CAMPAIGN

The 2019 spray campaign took place over 30 operational days between April 2 and May 9 and six additional operational days between May 16 and 26 for partial spraying pilot in three communities in BND, KD and GUD. Ghana sprayed more peri-urban and hard-to-reach communities earlier in the campaign than in 2018. This allowed starting revisits to the peri-urban areas early in order to reduce the number of refusals and locked structures and reach the communities that would likely be cut off by rains.

Spray operations ran for six days per week, from Monday to Saturday, in accordance with the schedule jointly developed by VL Ghana and district partners. Daily spray activities at each operations site began at 6:00 am, with field departure at 7:00 am. Site Managers assigned spray teams to communities and allocated vehicles for transport. As part of the morning mobilization activities, Site Managers and FSs held morning assemblies where they addressed SOPs and TLs on field findings and expectations for the day. The data team also addressed SOPs on data card errors. TLs filled out health-check forms for each SOP, to ensure that all team members were healthy for the field work. After the SOPs retrieved the leftover insecticides from the soak pit barrels, they departed to the communities for the spray work.

In the field, FSs and TLs supervised the distribution of SOPs to compounds designated for spraying that day. TLs conducted Directly Observed Spraying (DOS) while FSs conducted homeowner preparation and SOP performance observations. SOPs recorded data using the SOP daily data collection form.

At the end of daily activities, TLs conducted data verification on forms submitted by SOPs to check for arithmetical and other common errors and make corrections. TLs summarized all SOP data and submitted them to FSs. The FSs further verified the data and submitted them to the Site Managers. Site Managers used summarized data to complete the Spray Performance Tracking Sheet, which was posted on the walls in each operations site. Lastly, Site Managers ensured all spray data cards were delivered to the data center at the end of each spray day for entry.

Rain interrupted 2019 spray operations for one day: teams in six operations sites could not even depart for the field; all other teams went out but returned after the rain began in their areas, with very low spray output. In GUD, where there is a major market, the district IRS team adjusted the spray calendar around the market days. Teams in the partial spray pilot districts of BND, GUD, and KUD completed spraying communities in three, three, and five days, respectively, after the official end of the campaign due to delay in NMIMR pilot protocol approval.

At the end of IRS operations, all implementing districts had exceeded both the respective PMI and NMCP coverage targets of 85 and 90 percent. To ensure high spray coverage, the project team had to manage some challenging situations: In KUD, unsuccessful job applicants asked their communities to refuse IRS. Gaa community in GUD initially refused IRS because only one of three job applicants from the community had been hired due to the limited number of SOPs required; after several meetings with the leadership, the Gaa community agreed to be sprayed. Also, four shea nut-collecting communities (two in KAD and two in GUD) required special meetings engaging the GHS and District Assembly to correct misinformation about IRS and its effects on the production of organic shea butter, which representatives of nut exporting companies had spread among IRS beneficiaries in 2018.

3.2 IRS SUPERVISION

VL Ghana maintained thorough monitoring and supervision at all levels – regional, district, and operations site – during the campaign. The VL Ghana technical team supervised at the regional level. This included overall IRS operational and managerial support, and oversight of all districts. The district-level monitoring team included district operations coordinators (DOCs), M&E assistants, and district logistics assistants. At the operations site level, supervisors included site managers, FSs, and TLs. Government partners (GHS and District Assemblies) actively participated in supervision, as did the visiting VL Vector Control Manager.

The Ghana team used VL project monitoring and supervisory tools. Each supervisor was required to complete a certain number of tools in a day for effective supervision according to daily targets developed for all actors (Annex B).

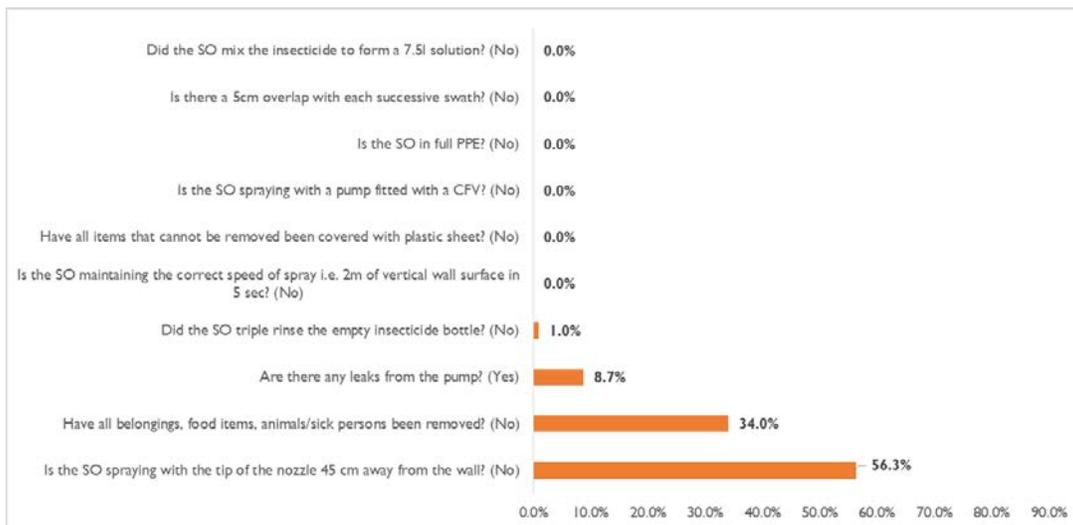
3.3 DIRECTLY OBSERVED SPRAYING

In 2019, VL Ghana continued using the Directly Observed Spraying (DOS) form it introduced in 2016. All TLs and FSs were trained on use of the paper-based DOS form on which they record observations of SOPs' spray techniques. TLs' target was to fill out five DOS forms, and FSs had to fill out two DOS forms per day in addition to completing other supervisory tools. Data entry assistants (DEAs) entered data captured on the DOS form into the DOS database, also designed in 2016.

TLs and FSs conducted 17,662 DOS inspections over the spray campaign period. Of these, 17,559 (99.4 percent) inspections did not raise any red flags. The remaining 103 (0.6 percent) inspections did so. The TLs and FSs addressed these red flags on the spot. Issues observed during DOS inspections were discussed every day at morning assemblies.

Analysis showed the majority of the 103 red flags (56.3%) indicated that SOPs sprayed with the tip of the nozzle positioned less than 45 cm away from the wall (Figure 1). In 34.0 % of the incidents, SOPs sprayed structures that had not been adequately prepared. Another 8.7% were due to insecticide dripping from the nozzle tips of spray pumps; this was caused by the lack of nozzle cups and SOPs not placing sieves correctly. The dripping was not the type that leads to insecticide spillage. A few pumps were observed with air escaping from around the neck of the plunger. The leak meant that the pumps were losing pressure faster than usual and SOPs had to pressurize them frequently. Supervisors repaired or replaced such pumps as soon as the problem was brought to their attention.

FIGURE 1. DISTRIBUTION OF DOS RED FLAGS BY QUESTIONS ASKED



One major challenge to DOS implementation was that some TLs were observed not recording their DOS findings immediately upon observing an error and instead waiting until the end of the day to complete the form. TLs reported that they waited to complete the form when they observed no errors. This issue was discussed and the proper procedure – that TLs must record all observations on the DOS form as soon as they see them – were clarified daily at morning assemblies. VL Ghana also sent out reminders on this to all TLs via SMS.

3.4 LOGISTICS AND STOCK MANAGEMENT

Store Assistants and District Logistics Assistants managed district and operations site stores and central warehouse. They updated and maintained inventory (stock cards, ledger books, and insecticide tracking sheets) and handled movement and tracking of IRS supplies and materials. Project supervisors regularly checked stock records and conducted a physical stock count, mostly of insecticides, to ensure uniformity across all inventory documentation and actual stock.

In 2019, store assistants serialized all insecticide bottles/sachets and used insecticide tracking sheets to track the insecticides that TLs received and returned daily at each operations site. At the close of each spray day, store assistants recorded all empty bottles and sachets and all returned full bottles/sachets from the field in the same forms to reconcile the inventory. Also, VL Ghana added a column to the SOP form to record the serialized insecticide number to indicate at which structure each insecticide unit was mixed and which structures were sprayed using the contents from that insecticide unit. This was to strengthen the project's insecticide stock management and reduce the risk of pilferage.

The District Logistics Assistants provided weekly inventory updates for each operations site in their respective districts. These updates formed the basis for re-supply requests and for reconciliation of the records with the central warehouse. To properly track materials' movement, all goods were accompanied by signed copies of material requests and delivery notes for each logistics transaction. The VL Ghana Logistics team also worked closely with the M&E team to ensure that records of used insecticides on stock cards corresponded with insecticide data reported in the project database.

3.5 MHEALTH: PHONE-BASED SUPERVISION

In the 2019 spray campaign, use of mobile phones for data collection and reporting continued. VL Ghana used mobile phones for data collection and messaging through technological platforms including CommCare, TextIt, and Open Data Kit (ODK).

All supervisory checklists were programmed on Android-based smartphones. VL Ghana team continued using Abt-managed ODK-based smartphone applications for supervisory and environmental checklist checklists and also those for environmental compliance. Other (government and seasonal) supervisors used these supervisory checklists as well as DCV and mobilization supervision checklists on the CommCare platform managed by Dimagi. In total, 9,752 inspections were conducted using smartphones over the 30-day spray campaign period. This total exceeds the total daily target set for mobile inspections (9,084) due to the high volume of DCV forms completed. The project fell short on submitting mobile forms for morning mobilization (73%) and storekeeper performance inspection (40%) but was close to the target for the end-of-day clean-up (90%) and home preparation /SOP performance (93%) inspections.

The use of the smartphones in field supervision yielded quick feedback when compliance issues were reported. The data were submitted to the server, and an email was generated with all issues and delivered to selected recipients (COP, operations manager, ECO, and the VL home office team). This enabled the team to follow up on issues and take corrective action. A Dimagi representative assigned to Ghana followed up with the team consistently throughout the 30-day campaign period.

IT, M&E, and the operations data coordinator resolved all technological issues encountered with the mobile-based system. For example, when some FSs inadvertently deleted the CommCare app on their phone, the operations data coordinator immediately reinstalled it. Some red flags reported through the mobile

submissions were found to be false. For example, there were reports of pump leakage and food contamination. On verification, the project established that the red flags were the result of an incorrect response or misunderstanding of the questions. Where a red flag was verified as accurate, the inspectors took corrective action, and as a follow up site management team discussed the issue during next day's morning mobilization. Table 4 includes the most common red flags observed.

TABLE 4. FREQUENT RED FLAGS AND CORRECTIVE ACTIONS

Red Flag Reported (number reported)	Corrective Action Taking
Is the spray operator smoking, eating, or drinking during household preparation or spraying (43)?	SOPs were cautioned NOT to eat/drink while spraying is ongoing.
Is the spray operator spraying floors, metal roofs, the outside of doors, glass, inside of cupboards, wallpaper, food granaries, curtains, latrines, animal pens (31)?	SOPs were advised NOT to spray non-sprayable surfaces.
Are there any items on the walls or hanging from the ceiling (posters, pictures, shoes, toothbrushes) (17)?	SOPs received re-enforcing message to work with homeowners to take down the hanging items if possible and remove all small items before spraying
Is there any water in the collection barrel at the beginning of clean-up (4)?"	Site managers were advised to ensure that leftovers are taken to the field in the morning.

3.6 MHEALTH: JOB AID MESSAGING

VL Ghana continued using the SMS job aid system that the Africa Indoor Residual Spraying (AIRS) Ghana project introduced in 2015. Table 5 provides examples of the job aid messages that were sent to spray teams over the 30-day campaign period. As the campaign progressed, VL Ghana modified the messages based on the issues reported through supervisory forms and field observations. For example, after a motorbike accident, VL Ghana sent out a specific reminder on personal safety measures about wearing helmets and maintaining the posted speed limit and checking road conditions when on the motorbike. All messages were sent before 7:00 am and in total, over 22,000 SMSs were sent throughout the 30-day campaign period.

TABLE 5. SAMPLE OF 2019 SPRAY CAMPAIGN JOB AID MESSAGES

Message	Group Sent To
Good morning! Full PPE use remains mandatory for the duration of the spray operation.	TLs and SOPs
Please remember your target is to perform the homeowner preparation and spray operator performance inspection in 5 compounds daily.	SUPs
Check if all your SOPs are feeling well and ready to spray at least 20 structures today! Don't forget to perform DOS daily!	TLs
No one should be harassed because of their Tribe, Religion, Age, National Origin, Disability, Race, Sex, Marital Status, Sexual or Gender Orientation. Report, if it happens to you!	All actors
Manage your team to use all insecticide in the field and bring minimal leftovers!	TLs, FSs
The VectorLink project is creating a safe work environment free from harassment of any kind follow the guidelines and be part of this process	SOPs, TLs, FSs
Remember to use appropriate tools while riding, helmets, check speed and road condition, securely tie all items at back of the bike and you must be a licensed rider. Your safety is your personal responsibility.	All actors

3.7 Nozzle Calibration

The spray nozzle is one of the most sensitive and important parts of the sprayer. It determines the amount of insecticide discharged and deposited on the spray surface. Nozzle calibration and replacement were conducted in all sites every Sunday throughout the campaign. The FS and site managers were responsible for this exercise at their respective operations sites.

In the 2019 spray campaign, the project used 637 nozzles. Of these, 28 nozzles were replaced during nozzle calibration: two replacements were due to out-of-range discharge and 26 were for the partial spray pilot.

3.8 HEAD LAMP PILOT

During the campaign, VL Ghana tested the use of head lamps in MMD. Feedback showed SOPs found a head lamp brighter and easier to use than a flashlight. They also found the lamp easy to clean at the end of the day and appreciated the ability to re-charge the lamp. Out of 45 purchased head lamps, only one was lost; the rest were returned in full function at the end of the spray operations. Supervisors observed that SOPs took better care of and greater responsibility for ensuring their head lamps lasted for the entire campaign. The project recommends scaling up use of the head lamps to all districts.



SOP outfitted with a head lamp.

4. ENTOMOLOGY

VL Ghana conducted spray quality assessments using standard World Health Organization (WHO) cone wall bioassays to test the quality of work by different spray teams working with the two types of insecticides used (pirimiphos-methyl and clothianidin). In each district, the project tested one community.

Houses were systematically sampled to represent different SOPs from different spray teams. The bioassays were carried out on mud and cement walls, and wood from doors and windows, which form the main types of sprayed surfaces in most communities.

The dead and alive mosquitoes were counted after the 24-hour holding period, and the percent mortalities were calculated for the pirimiphos-methyl-sprayed communities. For the bioassays from clothianidin-sprayed communities, if mosquitoes were alive after 24 hours, observation was continued until all test mosquitoes died (or up to three days). The high percentage mortalities recorded from the bioassays at different wall heights in all sites suggests uniformity in spraying by the spray teams. The test results also showed that both pirimiphos-methyl and clothianidin had fumigant effects (Annex C). This fumigant effect as reported previously could be dependent on the amount of aeration in a particular room, since very low mortalities were also recorded in tests from some rooms (in some sites) with more windows. Table 6 provides a summary of the bioassay results.

TABLE 6. SUMMARY OF WALL BIOASSAY TESTS QUALITY CHECKS, T0

Pirimiphos-methyl Sprayed Districts				
Sentinel Site	Mosquito Origin	24-hour Mortality Rate % (n)		
		Cement	Mud	Wood
Gushegu (GUD)	Kisumu	100% (60)	100% (59)	100% (40)
	Wild	100% (60)	100% (60)	100% (40)
Karaga (KAD)	Kisumu	100% (48)	100% (56)	100% (38)
	Wild	100% (59)	100% (60)	100% (40)
Namong I (YND)	Kisumu	100% (30)	100% (90)	100% (40)
	Wild	100% (30)	100% (90)	100% (40)
Boaterigu (BND)	Wild	100% (58)	98.3% (58)	100% (41)
Mbanaa Yili (KUD)	Wild	100% (60)	100% (58)	97.5% (40)
Gupanarigu (KUD)	Kisumu	100% (59)	100% (55)	100% (40)
	Wild	100% (30)	100% (30)	100% (20)
Gbullung (KUD)	Kisumu	100% (60)	100% (60)	100% (38)
	Wild	100% (57)	100% (55)	100% (40)

Clothianidin Sprayed Districts

Sentinel Site	Surface Type	Mosquito Origin	% Mortality Rate (Number tested)		
			Day 1	Day 2	Day 3
Arigu (WMD)	Mud	Kisumu	100% (56)		
		Wild	100% (51)		
	Cement	Kisumu	100% (111)		
		Wild	100% (108)		
	Wood	Kisumu	100% (53)		
		Wild	100% (49)		
Kunkua (MMD)	Mud	Kisumu			
		Wild	100% (54)		
	Cement	Kisumu			
		Wild	100% (113)		
	Wood	Kisumu			
		Wild	100% (49)		
Nalerigu (EMD)	Mud	Kisumu	100% (51)		
		Wild	93.3% (56)	100% (56)	
	Cement	Kisumu	100% (56)		
		Wild	100% (54)		
	Wood	Kisumu	90.0% (55)	100% (55)	
		Wild	97.9% (53)	100% (53)	
Yagaba (MMD)	Mud	Kisumu	100% (55)		
		Wild	95% (24)	100% (24)	
	Cement	Kisumu	97% (58)	100% (58)	
		Wild	90% (29)	96% (29)	
	Wood	Kisumu	86% (54)	97% (54)	
		Wild	100% (30)		
Kata-Banawa (WMD)	Mud	Kisumu	100% (37)	100% (37)	
		Wild	63% (59)	100% (59)	
	Cement	Kisumu	95% (40)	100% (40)	
		Wild	69% (59)	100% (59)	
	Wood	Kisumu	84% (36)	100% (36)	
		Wild	77% (38)	100% (38)	
Zaratinga (EMD)	Mud	Kisumu	100% (30)		
		Wild	100% (38)		
	Cement	Kisumu	92% (39)	100% (39)	
		Wild	82% (43)	100% (43)	
	Wood	Kisumu	97% (34)	100% (34)	
		Wild	93% (30)	100% (30)	

5. MONITORING AND EVALUATION

Together with the home office team, VL Ghana improved and adapted the M&E systems to meet the new data collection protocol, which captures data at the structure level, rather than the traditional compound level. This is to ensure that all eligible structures are captured in the database and can be identified during DCV. The decision to do this was informed by lessons learned and previous best practices; its main purpose is to count the number of structures locked for more than six months from the time of spraying.

5.1 DATA COLLECTION AND DATA MANAGEMENT

VL Ghana uses standardized forms to collect data on spraying and mobilization activities. For the 2019 spray campaign, after training on data capture and entry, mobilizers collected only enumeration data in CHD this year (as noted above, civil unrest forced the cancellation of spraying in CHD), and SOPs collected all spray data.

The new data collection protocol requires spray data capture by structure. For this, VL Ghana modified the Daily Spray Operator form and developed a new coding system in which the SOP marked each structure in a compound with a unique number (01, 02, etc.). They also had to mark structures as sprayed (S) or not sprayed (X or NS), so that SOPs who did revisits could easily distinguish between sprayed and unsprayed structures.

Other data collected during the campaign included human resources data (the number people trained and the number hired). Trainers and the project technical leads collected and reported the data to the M&E team. For revisits, the project used 2018 mobilization data² and spray data from 2019. For quality assurance, it used a number of methods, listed in Annex D.

This year, the project recruited an additional M&E Assistant for each district to conduct the DCV visits only. These eight DCV Assistants conducted data verification in 2,955 compounds using a phone-based form. Table 7 presents major DCV issues observed.



SOP collecting spray information, EMD

² In 2018, VL Ghana conducted door to door mobilization and enumeration, and used this data to guide revisits in 2019. No door-to-door mobilization occurred prior to spray in 2019

TABLE 7. DCV FORM: ISSUES AND CORRECTIVE ACTIONS

Errors/Issues Observed	Corrective Actions Taken
<p>Undercount of eligible structures found. Some new SOPs did not count all eligible structures in compounds. One reason for this is that a household might use a structure for multiple purposes, e.g., for food storage and sleeping. Such structures become eligible after the food items are moved to the market. Eligibility and capture of such structures depends on when the SOP visits the compound.</p>	<p>SOPs involved in non-recording of eligible structures were given on-the-spot refresher training. They also were instructed to investigate the status of a sleeping place also serving as a food store to determine when the structure becomes eligible for spraying. If the multi-use period exceeds the 30-day campaign, the structure is considered ineligible and not recorded.</p>
<p>Over-count of eligible structures found. In assigning structure numbers, as per the new protocol, some (especially new) SOPs numbered rooms as structures. Other SOPs numbered every structure in the compound and then sprayed the eligible ones only.</p>	<p>SOPs were reminded of the definition of and how to identify eligible structures. During morning, mobilization, the SOPs were re-trained on differentiating between rooms and structures and on counting structures. Supervisors and the TL were tasked to intensify the structure marking/capture checks.</p>
<p>Over-count of eligible structures sprayed. Some SOPs counted rooms sprayed as structures. For instance, one structure with three rooms sprayed was treated as three structures, leading to an over-count of structures sprayed. Some new, inexperienced SOPs got confused in compounds with a large number of structures. They may also have double counted sprayed structures.</p>	<p>SOPs were trained to differentiate rooms from structures and cautioned about this even before IRS operations started. SOPs were taken back to the compounds involved for necessary correction. TLs and FSs intensified field spot checks to avoid the error. The entire spray team was reminded to be mindful in counting sprayed structures on compounds with many structures.</p>
<p>Undercount of structures sprayed. In large compounds with many courtyards, some SOPs undercounted the structures they sprayed.</p>	<p>SOPs were advised to carefully count both eligible and sprayed structures in large compounds. They were asked to approach the count by courtyard and do proper marking with chalk for sprayed/ unsprayed structures. TLs and FSs were instructed to assist in counting structures on such compounds.</p>

5.2 DATA ENTRY AND CLEANING

Out of 38 trained persons, VL Ghana hired 34 as DEAs. It assigned four of the DEAs initially hired for CHD to EMD and WMD due to the increased volume of data entry as a result of data entry at the structure level. Four DEAs hired as a buffer replaced the ones who resigned during the campaign.

The database set-up entailed using a server and laptops in each data entry center. VL Ghana installed the 2019 version of the project Microsoft Access database and the DOS database on 38 laptops to ensure simultaneous and timely data entry and syncing across all districts.

VL project data entry protocols dictate a two-step process for data entry. First, “Totals” data entry captures the summary totals from each Daily Spray Operator form. It is supposed to be completed within 24 hours of the SOP form reaching the data center. These data are used for monitoring daily spray progress. The second is “Details” data entry, where data for every line of the Daily Spray Operator form are entered into the database. It is completed within 48 hours of the SOP form reaching the data center. DEAs carried out data cleaning on a daily basis using a Microsoft Access-based IRS Cleaning/Reporting tool. The data-cleaning process involves compliance with the two-step data entry protocol, comparing the Totals and Details data, checking for and possibly removing duplicate records, and identifying and entering missing records.

Unlike in 2018, when each line of data represented a compound, a line of data in the 2019 forms represented a single structure. This change slowed daily data entry and required a higher level of effort than was estimated. To catch up with “Total” inputs, VL Ghana had to reassign better-performing DEAs to the larger districts. The project will consider re-introducing a phone-based performance monitoring tracker (PMT) to

ensure raw spray performance data are available within 24 hours in 2020. This system was previously used in Ghana under the AIRS project with the assistance of Dimagi, the mHealth partner. Many VectorLink countries currently use a mobile-based PMT system. Given the quick 24 hour turnaround time from the SOP forms receipt to data entry to data cleaning, Ghana decided to forgo use of the mobile PMT system in 2017. However, with the change of data collection from “the compound” level to “the structure” level, increased data volume led to delayed data entry and key PMT indicators were not readily available at the end of each day of spray for quick decision making. Also, in anticipation of the transition to the VectorLink Collect database in 2020, VL Ghana is considering bringing back a separate phone-based PMT system that would automatically aggregate data from all operations sites and send email updates to a selected list of recipients to track key performance indicators daily. The key indicators the PMT system would track are:

1. Number of structures found
2. Number of structures sprayed
3. Number of insecticide bottles used
4. Number of SOPs worked that day

The new protocol of data capture by structure presented new challenges for the DEAs such as duplication of structure number and incomplete compound ID. In the absence of clear information, the DEAs would follow up with specific SOPs to solve these issues. TLs and mobilizers returned to the communities to verify the data.

5.3 RESULTS

The VL M&E matrix provides details of all program indicators in Annex E. A summary of results for core and other spray indicators for the 2019 campaign is presented below.

5.3.1 SPRAY COVERAGE AND POPULATION PROTECTED

By the end of the spray campaign, SOPs had found 316,285 structures and sprayed 298,385 of them. This translated into 94.3% coverage for the eight districts, a 2.3% increase from last year. In comparison to the 2018 campaign, VL Ghana found 8,419 fewer eligible structures and sprayed 316 less structures than last year. The shortfalls are primarily due to damaged houses (most of them mud structures with short lifespans), change of status from eligible to ineligible (multi-purpose use of structures), and exclusion of structures identified as locked for more than six months. Because the project introduced “by structure” data capture, SOPs were able to identify 1,140 structures that will be locked for more than six months, which the project classified as not eligible for spraying because they would not be occupied during the malaria transmission period (May-October). Thus, the denominator for calculating the spray coverage (structures found in 2019) was adjusted to the removal of these ineligible structures.

The campaign found 913,773 people living in the structures found, of which 95.8% (875,481) were protected from malaria through IRS. This figure includes 19,844 pregnant women and 157,398 children under five years of age.

Details on the number of structures found, sprayed, and district spray coverages are presented in Table 8.

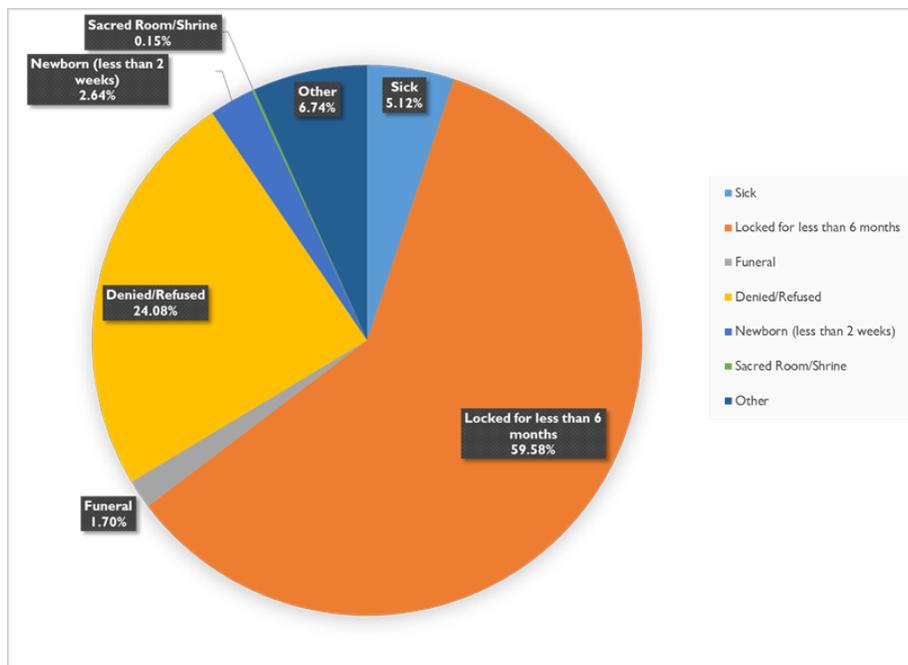
TABLE 8. SUMMARY OF 2019 SPRAY RESULTS

District	Structures			Population			Pregnant Women Protected		Children <5 Protected	
	Found by SOPs	Sprayed	% Sprayed	Protected	Not Protected	% Protected	#	% Protected	#	% Protected
BND	40,397	39,264	97.2%	99,215	2,288	97.7%	1,709	1.7%	13,473	13.3%
EMD	75,432	71,466	94.7%	205,916	7,660	96.4%	4,478	2.1%	36,700	17.2%
GUD	45,511	43,299	95.1%	136,384	5,050	96.4%	3,138	2.2%	28,350	20.0%
KAD	30,879	28,862	93.5%	94,426	4,504	95.4%	2,493	2.5%	19,285	19.5%
KUD	33,421	30,871	92.4%	88,674	5,622	94.0%	1,921	2.0%	15,538	16.5%
MMD	21,968	20,495	93.3%	61,608	3,265	95.0%	1,468	2.3%	11,466	17.7%
WMD	54,123	49,655	91.7%	149,225	9,741	93.9%	3,862	2.4%	26,714	16.8%
YND	14,554	14,473	99.4%	40,033	170	99.6%	775	1.9%	5,872	14.6%
Grand Total	316,285	298,385	94.3%	875,481	38,300	95.8%	19,844	2.2%	157,398	17.2%

5.3.2 REASONS WHY STRUCTURES WERE NOT SPRAYED

Out of the 316,285 structures found by SOPs for the 2019 campaign, 17,900 (5.7 percent) were not sprayed (Figure 2). Reasons for not spraying them were captured under the following categories: structure will be locked for less than six months (10,664); denied/refused to spray (4,310); sick person(s) in the structure (916); newborn in the structure (473); funeral (304); and sacred room or shrine (26). “Other” reason was indicated for 1,207 structures.

FIGURE 2. REASONS FOR NOT SPRAYING STRUCTURES



5.4 AVAILABILITY AND USE OF MOSQUITO NETS

SOPs recorded 189,469 mosquito nets available in the eight districts. Of the population protected, 42.4% of pregnant women and 44.3% of children under five years old were using the nets at the time of the visit. Table 9 presents net indicators by district.

TABLE 9. NUMBER AND USAGE OF MOSQUITO NETS AMONG VULNERABLE POPULATIONS

District	Total Mosquito Nets Found	Pregnant Women Sleeping under Mosquito Nets the Previous Night		Children Under 5 Sleeping under Mosquito Net Previous Night	
		#	%	#	%
BND	21,287	818	47.9%	7,369	54.7%
EMD	38,808	1,630	36.4%	14,481	39.5%
GUD	24,648	1,089	34.7%	10,713	37.7%
KAD	19,717	1,000	40.1%	8,197	42.5%
KUD	18,731	829	43.1%	7,168	46.0%
MMD	19,969	882	60.0%	7,369	60.9%
WMD	40,345	1,898	49.0%	12,753	47.7%
YND	5,964	271	35.0%	2,141	36.5%
Total	189,469	8,417	42.4%	69,820	44.3%

5.5 OTHER SPRAY INDICATORS

For the 2019 spray campaign, a total of 37,931 bottles of Actellic were distributed in the Actellic sprayed districts (BYD, GUD, KAD, KD) and 34,818 sachets of SS in the SS sprayed districts (EMD, MMD, WMD). Of the quantities distributed, 33,783 bottles of Actellic and 32,971 sachets of SS were used to spray 298,385 structures. On average, each container of insecticides covered 4.5 structures. Table 10 summarizes insecticide tracking and usage information.

TABLE 10. INSECTICIDE TRACKING AND SOP PERFORMANCE

Indicator	District								
	BND	EMD	GUD	KAD	KUD	MMD	WMD	YND	Overall
Structures found	40,397	75,432	45,511	30,879	33,421	21,968	54,123	14,554	316,285
Structures sprayed	39,264	71,466	43,299	28,862	30,871	20,495	49,655	14,473	298,385
Total insecticide used	8,567	16,405	8,912	6,119	6,996	4,626	11,940	3,189	66,754
Actellic	8,567		8,912	6,119	6,996			3,189	33,783
SS		16,405				4,626	11,940		32,971
Average # of structures/unit of insecticide	4.6	4.4	4.9	4.7	4.4	4.4	4.2	4.5	4.5

6. ENVIRONMENTAL COMPLIANCE

Complying with environmental regulation is a fundamental requirement for ensuring an effective, safe, and ultimately successful spray operation. The safety of community members and IRS personnel must be protected; this includes appropriate handling of insecticide and waste. VL Ghana conducted the 2019 IRS campaign under Amendment 1 of the Supplemental Environmental Assessment for 2015–2020. IRS campaign activities were fully compliant with standards of EC protocols and procedures. Annex F provides details on the Environmental Mitigation and Monitoring Report.

To ensure strong EC, USAID evaluates VL Ghana EC procedures for and compliance with international safety standards every two years. From April 9 to 17, 2019, a technical expert from the Environmental Compliance and Operational Support (ECOS) project conducted an environmental assessment of VL Ghana’s IRS implementation in 14 operations sites in all eight districts.

6.1 PRE-SEASON ENVIRONMENTAL COMPLIANCE ASSESSMENT AND RENOVATIONS

The VL Ghana ECO, with the support from Ghana’s EPA representative and District Environmental Health Officers (DEHOs) from all IRS districts, visited 26 operations sites in the nine districts (including CHD) to conduct a pre-season environmental compliance assessment (PSECA).

The project carried out the initial PSECA on December 3–12, 2018. Based on the assessment findings, the ECO generated and shared with the entire operations team a worklist indicating repairs required at each operations site. The main task was to convert all fixed soak pits that were due for upgrade to a newer design with plastic lining and metal covers. The project upgraded 25 soak pits (including CHD) except for the one at Kpasenkpe (WMD), which is due for rehabilitation in 2020. Other (minor) improvements included fixing cracks in wash areas, desilting and refilling some soak pits, changing locks and painting some insecticide storage rooms. Site renovations started simultaneously across all sites from January 10 through February 22, 2019.

In addition, the project added a soak pit for the Zanteli site (GUD) bringing the total number of fixed soak pits to 273. To avoid repeatedly repairing cracks in the cemented areas of soak pits, since 2017, the project has covered the wash areas with thick tarpaulins to allow all effluent waste to flow freely into the bio-bed without escaping through the cracks.



ECO and DEHO inspecting newly constructed soak pit at Yizesi, MMD

The ECO together with the EPA officials and DEHOs carried out final inspections and certification of the storage facilities and soak pits on March 11–21, 2019. Following these certifications, the home office EC Manager gave a green light to the commencement of 2019 IRS campaign at all the operations sites in time for the planned start of IRS on April 2, 2019.

3 Three sites have two fixed soak pits: Wungu (WMD), Gambaga (EMD) and Zanteli (GUD).

Ghana also put up a storage facility at Kpatinga (GUD) in collaboration with the GHS and the support of Kpatinga chiefs and residents, who provided the land as their contribution to the campaign. The facility was set up to avoid the long daily travel time from the community to the main operations site.

6.2 USE OF MOBILE SOAK PITS

For the 2019 spray campaign, VL Ghana introduced the industrial MSP (MSP II), which can serve up to three spray teams. The project used 17 MSPs in the 2019 spray campaign: 15 were regular MSPs and two were MSP II. The two MSP IIs supported the fixed soak pits in Kumbungu (KUD) and Bunkpurugu (BND) sites that had 41 and 36 SOPs, respectively. One regular MSP was used to support the 30 SOPs at the Karaga site (KAD). At the end of the spray campaign, all MSPs were uninstalled and the sites decommissioned according to PMI Best Management Practices.

6.3 MID-SEASON ENVIRONMENTAL COMPLIANCE ASSESSMENTS

As part of the mid-season EC assessment, the ECO with other supervisors visited all 24 sites with fixed soak pit and seven sites with MSP sites to assist and support the district teams with environmental compliance.

During the campaign, the ECO carried out multiple inspections using the mobile forms on ODK. As a result of improvements in the CommCare mobile application, there were only a few errors in the supervisory forms other supervisors and government officials submitted using the application. The ECO and operations data coordinator followed up whenever they received an email alert about a non-compliance issue. Common errors encountered during the campaign (see Section 3.5) will be used to improve future training, especially training on the use of smartphones during inspection visits.

6.4 DAILY SOP HEALTH CHECKS

The project introduced Daily SOP Health Checks in 2016 to ensure SOPs are in good health prior to starting the day's spray activities. The daily checks continued in 2019. TLs performed the health checks every morning by interviewing their SOPs and filling out a five-question form. SOPs were to report any identified health issues to the supervisors or site manager each morning. All completed health forms are filed and kept at the district level for future reference.

6.5 INCIDENTS

VL Ghana experienced five incidents during the 2019 IRS campaign (Table 11).

This year, the project made an effort to ensure safe driving by contracting an independent inspection company, GUB-GBAI Engineering Works, to assist in inspecting vehicles prior to the project contracting the vehicle for the spray campaign. In 2019, all supervisors came on board with personal motorbikes, which DOCs inspected at the district level. The supervisors signed a disclaimer absolving the project of any liability. All supervisors had basic driving skills and were licensed drivers. One motorbike was involved in an accident.

The project witnessed only one case of insecticide pilferage, down from three cases in 2018. Reduction in such cases is likely due to the project introducing the guarantor's form for SOPs and TLs, as well as insecticide coding and intensified supervision and verification.

TABLE 11. 2019 PMI VECTORLINK GHANA INCIDENT REPORT SUMMARY

Incident ID	Description of Incident	Location
GH-040519-001	Health and Safety: Two armed robbers attempted to rob the driver of a rented bus on Kpasenkpe road.	Walewale (WMD)
GH-040819-002	Health and Safety: A supervisor continued to complain about dizziness and headache.	Nasuan (YND)
GH-040919-003	Accident: An SOP, using a project-owned motorbike to deliver a megaphone to a mobilizer at Wundua, was involved in an accident near the Langbensi site.	Langbensi (EMD)
GH-050319-004	Health and Safety: An SOP reported feeling unwell.	Nagboo (EMD)
GH-052219-005	Theft: An SOP was found to have stolen 21 sachets of SS insecticide. The insecticide was recovered.	Kparigu (WMD)

6.6 POST-SEASON ENVIRONMENTAL COMPLIANCE ASSESSMENT

The project closed down all storage facilities and soak pits in all 24 operations sites within two weeks after completion of IRS and in accordance with PMI Best Management Practices. All solid waste (nose masks, gloves, empty bottles/sachets) was transported to the district stores in Kumbungu (KUD), Langbensi (EMD), and Walewale (WMD). Post-spray EC inspections will be conducted in June 2019. Storage facilities will remain locked and guarded until the next spray campaign. The DOCs will make sure district storage facilities and all soak pits remain secured and clear of vegetation during the off-season.

6.7 WASTE DISPOSAL

VL Ghana will continue to partner with Cyclus Elmina Plastic Recycling Limited and Zoil Service Ltd to dispose of the IRS solid waste. All non-plastic IRS solid waste (used nose masks, excavated charcoal and sawdust, and used granulated activated carbon (GAC) from MSPs) was packed into bags and is awaiting incineration at Zoil Service Ltd in Takoradi in August–September 2019.

All triple-rinsed empty Actellic bottles and empty SS sachets from the campaign will be sent in August to Cyclus Ltd for recycling and Zoil Services Ltd for both recycling and incineration. All uncontaminated cardboard from Actellic and SS packaging will be recycled at Fine Print Ltd in Tema-Accra. The ECO and a representative from the Ghana EPA will observe the recycling and incineration of IRS waste. VL Ghana will obtain a certificate of destruction from the companies for its records.

VL Ghana has not been able to identify a company to recycle the torn gloves, but it continues to search for waste management companies that can do this. In the interim, the project donated used gloves and aprons to Vision 1 Funeral Home & Mortuary at Aburansa near Cyclus Ltd for reuse. The project will give away well-washed but damaged coveralls and rubber boots to best-performing SOPs for personal use.

7. SOCIAL AND BEHAVIOR CHANGE ACTIVITIES

SBC assistants began activities in their assigned operations sites on February 1. Activities were simultaneously carried out across all sites. VL Ghana used Community Communication Work Plans drawn up with the GHS Health Promotion Unit as a road map for 2019 mobilization and outreach work. The work plans included community entry visits, community preparation, enumeration, spray campaign mobilization, and pre- and post-spray stakeholders' meetings. IRS communication focused on improving the participation of communities in IRS implementation and integrating IRS into routine community-level communication through the Health Promotion Unit.

The project used interpersonal and mass media communication strategies to carry out SBC activities. The interpersonal communication strategies targeted community leadership and individual beneficiaries, and included door-to-door communication, meetings, and outreach events. Mass media strategies targeted community members to ensure wider coverage with information and educational messages through the use of video shows on IRS and malaria, radio discussions with call-in segments, and use of informational vans to conduct outdoor mass education activities.

7.1 INTEGRATING IRS INTO ROUTINE GHS HEALTH PROMOTION ACTIVITIES

This year, the project intensified its collaboration with the Northern Regional Health Directorate of the GHS to integrate IRS into community-level health promotional activities in all IRS districts. For the first time, the project engaged Community Health Nurses (CHNs), a foundation of the GHS' community health promotion structure, in IRS implementation. VL Ghana assigned 46 project-trained CHNs to the operations sites and requested that they incorporate IRS messages into their routine health promotion activities at the facility level (antenatal clinics, child welfare clinics, and outpatient departments). The CHNs were trusted voices, especially in areas where they are recognized and have influence. During the spray campaign, they worked closely with the spray teams, addressing the issues raised by households and reducing refusals. The project monitored their performance and reviewed submitted final IRS reports from all CHNs, which demonstrated that the integration of IRS messages began in March, right after the training, and continued through May.



A Community Health Nurse educating community on importance of IRS, BND

However, because the project did not train all CHNs operating in the IRS districts, district-wide integration of IRS messages into all routine health promotion activities was a challenge. The GHS assigns CHNs to work in particular zones. There are more zones per district than project's IRS operations sites. Usually, VL Ghana has two sites per district. This meant that the two CHNs trained by the project had to work outside of their zones in order to cover their IRS operations site. Thus, IRS beneficiaries in some zones, where the CHNs were not known, were less receptive to the information the CHNs delivered.

Therefore, in 2020 the project plans to engage more CHNs in order to expand IRS integration into routine GHS health promotion at the community level and further enhance IRS acceptance for entire districts.

7.2 IMPROVING QUALITY OF COMMUNITY PARTICIPATION

The project held community meetings in all operations sites from February 1 through the end of spray. The meetings were a platform from which to engage IRS beneficiaries and influential people. The project also held meetings in shea nut-collecting communities in GUD and KAD prior to the spray campaign. Except for Nyengbolo (KAD), IRS acceptance improved in all shea nut communities. In total, the project conducted 1,502 meetings attracting 28,348 participants.

This year, the project introduced Final Community Meetings to improve community participation in IRS. These meetings, held one week prior to a community's spray day, differed from the regular community meetings. During the meetings, the project brought up topics usually discussed at pre-spray stakeholders meeting including trends and targets of spray coverage. The participants were informed of the prior year's spray coverage and this year's targets required for effective IRS within their community. They used this information to better prepare for the upcoming spray.

The project introduced the Community Spray Calendar poster during these meetings. The calendar had a space to write down name of a community, spray dates, and last year's coverage. The posters were completed during the meetings and displayed in public places to inform those who missed the meeting about spray dates and serve as a reminder to all residents. In all, the project held 578 Final Community Meetings, which 13,378 participants attended, and posted 7,382 Community Spray Calendars, which reduced residents' complaints about not receiving information in time for spray. Going forward, the project will include a section on the Community Spray Calendar for communities to write down the spray coverage they intend to achieve during the upcoming spray campaign as an additional incentive for obtaining community buy-in.

7.3 COMMUNITY EDUCATION

Community education is vital given the long gap between the spray campaigns. Community education activities provide the project the opportunity to identify issues that may have come up between campaigns and educate communities to ensure that these issues do not become barriers to accepting IRS during the campaign.

One key item for education this year was introduction of a different insecticide in the two largest IRS districts, which have nearly one-third of the project's structures (127,654 out of over 324,000 found in 2018). The two districts, EMD and WMD, rotated insecticide from Actellic to SS. All communities in the two districts were educated on the change of insecticide, its mode of action, what to expect when SOPs come to mix the insecticide, and the homeowner's preparation and post-spray clean-up procedures (which were the same as the insecticide used previously).

VL Ghana together with district HPOs and CHNs conducted outreach and educational activities (Table 12) using venues such as mosques, churches, schools, health facilities, and gatherings of farmers, women, and youth groups, and other associations.

TABLE 12. NUMBER OF COMMUNITY EDUCATION EVENTS

Activity	BND	YND	EMD	GUD	KAD	KUD	MMD	WMD	Total
Door-to-door outreach for households with high number of locked structures	132	89	573	72	93	142	152	679	1,932
Mosque and church outreach	95	89	112	84	37	15	36	121	589
Educational outreach (primary schools, junior/senior high schools, vocation/ technical schools visited)	53	27	39	44	33	39	16	28	279
Information van (communities visited)	6	6	10	38	46	101	75	70	352
Health outreach (antenatal clinics, Community Health Planning and Service compounds visited, etc.)	86	21	91	50	23	12	26	37	346

7.4 MASS MEDIA CAMPAIGN

Mass media has been a critical part of the project’s communication strategies (Table 13). Radio was the main channel used by the media campaign, which began on March 18 and ended on May 31. The project contracted six local radio stations to broadcast in the IRS districts. The radio stations developed media plans to carry out radio programming on IRS during that period. The programming included playing spots and jingles, holding interactive radio discussions, and announcing spray dates. This year, all stations included live presenter mentions in their various radio shows to support the campaign using knowledge gained in IRS implementation from their capacity building training.

Each of the six radio stations had two staff attend the project’s training on IRS, so they could support the spray campaign. The training aimed to build their understanding of how IRS works as a malaria control strategy, the importance of homeowner preparations, and the communal nature of IRS and responsibility of each community member to control malaria.

To complement the training, each of the media personnel worked on the campaign for five days to experience IRS and bring this experience to their broadcasting. They worked on refusal cases and helped to educate households as they worked alongside the spray teams. This helped to influence their LPMs and radio discussions as they had heard the misconceptions and concerns about IRS that people in the targeted communities had.

Video shows were held in 22 communities to address misconceptions and concerns on IRS, malaria transmission, and effects of malaria on children under five and pregnant women, and to improve the uptake of IRS as an intervention for malaria prevention.

The media campaign also used printed materials. Posters detailing steps involved in homeowner preparations and after spray clean-up were distributed during the household enumeration in CHD in February and in the other districts in March. This poster was reprinted together with Community Spray Calendar.

The “gong gong” is a traditional community communication tool usually owned by the chief, who beats it to summon the community to meetings or to announce very important events about to happen in the community. They were used to announce spray dates, especially in remote rural settings.

The project worked with imams across all the communities to help announce spray dates and encourage acceptance of IRS in their communities. Announcements were made with the aid of megaphones used to call for prayer. These announcements were usually made a day prior to spray as well as early in the morning on the day of spray, during the first call for prayer.

TABLE 13. MASS MEDIA CHANNELS USED TO SUPPORT SPRAY CAMPAIGN

Activity	Total Number
Radio spots; jingles	990
Radio programs (interactive shows)	36
Radio announcements	420
Video shows	22
IRS Homeowner Preparation posters distributed	5,000
IRS Community Spray Calendar posters distributed	7,382
Gong gong beating	1,206

7.5 MOBILIZATION

In 2018, VL Ghana undertook a one-time enumeration of households to obviate the cost of doing annual enumerations. A unique household serial number was issued to each compound, which the compound will use throughout the project. This will help the project to record the household's acceptance of IRS over time. In the future, the project will need to do enumeration only in new districts and in new compounds in the old districts.

With the planned expansion into CHD, VL Ghana did door-to-door mobilization to enumerate and sensitize all households. In all, 210 mobilizers were trained to do the mobilization from February 18 through March 15. The ethnic conflict described above prevented some mobilizers from submitting mobilization forms on some of the communities they had enumerated. However, a total of 5,422 households were enumerated in 146 communities out of 206 and 24,654 adults were reached with IRS messages. During the spray campaign, in all districts, each community was scheduled to be informed of their spray day three times: one week, three days, and a day prior to the spraying.

7.6 SBC ACTIVITIES MONITORING

VL Ghana, GHS, and District Assembly officials monitored SBC activities. To supervise enumeration in CHD, supervisors used a phone-based Mobilization Supervision Form developed under the PMI AIRS project. The form ensured that mobilizers correctly sensitized households and collected accurate enumeration data. In all, 105 supervision forms were submitted during the enumeration process.

During the spray campaign, VL Ghana and field supervisors used WhatsApp as a communication platform with SBC Assistants to report on mobilization activities, challenges, and solutions. The assistants benefited from real-time corrective feedback and guidance to avoid similar challenges.

VL Ghana staff, FSs, TLs, and SBC Assistants also used a paper-based Mobilization Attendance Record Form to monitor activities of persons designated to mobilize communities prior to and during spraying. They monitored activities of mobilizers, influential persons, and representatives of chiefs who were assisting with the mobilization. The main purpose of the form was to verify that the mobilizer actually showed up in his/her assigned community. Mobilizers had to sign in in the morning and sign out at the end of the day, after completing their work.

VL Ghana and district and regional HPOs supervised CHNs carrying out SBC activities. CHNs recorded their progress in the Health Worker Register for Health Promotion Activities and district supervisors reported CHN work in the national health information system on a monthly basis. During the spray campaign, the VL Ghana monitored CHN attendance using the Mobilization Attendance Record Form. Forty-six CHNs submitted records for 920 activities during the IRS campaign.

8. GENDER MAINSTREAMING

VL Ghana continued to improve its integration of females and to create a safe work environment for all staff. In 2019, the project focused on positions for which few females had applied to work, such as the site manager and FS. For the first time, the project recruited seven females as site managers and five as FSs. Another major achievement was a recruitment of one more female for the position of DOC.

In continuing project-wide improvements for a safe work environment for seasonal staff, gender focal persons from VL's Ghana and Kenya teams with guidance from the project's home office Gender Technical Lead developed 'Freedom from Harassment' guidelines. All seasonal staff were required to read and commit to complying with the guidelines as part of the work agreement they signed. The guidelines had direct helpline numbers to the Abt home office to report harassment. By the end of the campaign, no reports had been made to the knowledge of VL Ghana.

In 2019, the percentage of female SOPs was 22.6%, female TLs 26.2%, and female FSs 8.2 %. Table 14 summarizes the project's gender integration efforts.

TABLE 14. SUMMARY OF GENDER-RELATED INDICATORS, 2018–2019

Gender Indicator	Females Trained to Support IRS	Females Hired to Support IRS	Females Hired in Supervisory Roles [†]	Female SOPs Hired	Female TLs Hired
2018	18.5% (169)	15.5% (380)	14.2% (36)	21.1% (127)	20.7% (25)
2019	21.8% (188)	18.1% (469)	21.0 % (54)	22.6% (144)	26.2% (33)

Through joint working meetings and PMI VectorLink boot camp training in October 2018, the project's gender integration has inspired the Global Fund IRS implementing organization in Ghana, AGAMal, to begin engaging women in its field operations for the first time since its inception in 2006.



Female Supervisors and Site Managers practicing spraying technique, WMD

9. CAPACITY BUILDING

Between January and March 2019, VL Ghana conducted training on IRS for 30 officers from three GHS departments (Health Promotion and Communication, Warehouse and Logistics, and Health Information). Officers from the regional and district levels participated in these training programs: GHS Regional and District HPOs (to work with the SBC team); the Regional Warehouse Manager and District Supply Officers (to work with the logistics team); and the Regional Surveillance Officer and District Information Officers (to work with the project M&E team). The trainings took place in Tamale. For their part, the regional officials shared information on the latest malaria situation and presented organizational structure of their departments. The project will use this information to better identify opportunities for integrating IRS into routine work of these government departments.

Another major IRS training that the project organized was an IRS boot camp for over 30 government officials. DCOs and their deputies; DEHOs; representatives from the NMCP, EPA, and AGAMal; and presiding officers of districts implementing IRS participated in the eight-day immersive workshop.

In total, the project trained 35 representatives from the NMCP, EPA, HPOs DCOs, and DEHOs in the targeted districts as part of annual IRS trainings. To strengthen their practical IRS skills, HPOs, DCO and DEHOs worked for 20 days alongside VL Ghana staff during the campaign. DCOs and DEHOs used phone-based checklists for supervision and reported on 105 inspections this way. HPOs used a paper-based form to supervise community preparation/ mobilization activities; they ultimately submitted 180 forms. These forms enabled the project to monitor the HPOs' work in the field.

The project trained 51 CHNs (including five in CHD); all the District HPOs in the IRS districts who were the nurses' immediate supervisors, as well as the regional supervisors: the Regional Public Health Nurse and the Regional HPO.

During the IRS off-season, the CHNs are expected to continue including IRS in their educational outreach using the new brochure for community education as a resource for referencing IRS messaging. For this work, the project shared the data with them on low-coverage (consistently below target of 85%) communities dating from 2015 to the present, so they can focus on engaging these communities.

The media remains a vital partner in supporting the spray campaign by keeping IRS on the minds of communities and disseminating correct and authorized information on IRS effects and impact. In building the media's capacity, the project trained two personnel from each of the six community radio stations in IRS implementation. This enabled the radio stations to effectively communicate about the spray campaign, drive the campaign, and help resolve misconceptions about IRS to improve community acceptance. Through the project, PMI continued supporting NIRMOP. The partnership brings together researchers and vector control implementers within Ghana to generate and monitor insecticide resistance data in the country, under the guidance of the NMCP's MaVCOC. NMIMR coordinates data collection and hosts the MaVCOC secretariat. A key area of the partnership has been to provide the framework for sharing data on insecticide resistance in a collaborative way so as to support disease control strategies, especially those that require the use of insecticides.

10. POST-SPRAY ACTIVITIES

10.1 POST-SPRAY STAKEHOLDERS MEETINGS

Stakeholders meetings were held to mark the end of the 2019 spray campaign across all operations sites with District Chief Executives for some sites, local government staff, Directors of Health (and their staff), traditional and religious leaders, respected members of the communities and others. The project used this approach to engage stakeholders one more time as a means of rounding off activities for the year. The meetings were held on May 27–31 and provided the opportunity for each site to:

- i. Review their spray performance during the 2019 and assess the success of strategies discussed earlier during their pre-spray meetings,
- ii. Deliberate on issues unique to the communities covered by the site, which affected operations at the site, and
- iii. Provide a platform for sharing experiences.

Specifically, in KAD, the meeting addressed the issue of refusals. KAD District Assembly representatives reported that they had started drafting a health policy document that will require mandatory participation of the constituencies of all public health programs such as vaccination, family planning, and IRS. On rented locked structures in peri-urban areas, a participant in Gambago sub-district (EMD) suggested that landlords should talk to tenants about spraying their rooms by arranging to assign their keys to neighbors who could be available at the time of spray. In BND, the chief of Bimbago acknowledged the impact of IRS on the number of malaria cases in his area and suggested that stakeholders should engage the youth to accept IRS because this demographic group is seen as the largest in refusing IRS. The same chief encouraged other chiefs to take personal responsibility of IRS and other health-related activities in their communities.

The national post-spray evaluation meeting will be held on August 29 in Tamale. Participants in this meeting will include: the Overlord of Mamprugu and Paramount Chiefs of Kumbungu, Gushegu, and Karaga; officials from PMI, USAID, and the US Centers for Disease Control and Prevention; officials from the NMCP, GHS, and the Northern Regional Coordinating Council; representatives of the EPA; research institutions such as NMIMR; other IRS implementing agencies such as AGAMa; all District Chief Executives and their Directors of Health in IRS implementing districts; and other malaria-focused partners.

10.2 IRS DEMOBILIZATION

VL Ghana decommissioned all 24 sites and moved all logistics and spray equipment from the operations sites to the respective districts stores within two weeks after the completion of the 2019 campaign. The project moved all contaminated waste materials (hand gloves, used nose masks, and empty insecticides bottles and sachets) to the stores in Kunbungu, Langbensi, and Walewale for further proper disposal.

10.3 POST-SPRAY INVENTORY

After the 2018 campaign, VL Ghana had a balance of 11,100 bottles of Actellic and 376 sachets of SS. A total of 26,832 bottles of Actellic and 38,292 sachets of SS was procured. The project distributed the insecticide to the districts using First-to-Expire, First-Out approach to make sure 2018 leftover chemicals were used first. A total of 66,733 units of insecticide were consumed during the 2019 campaign (Table 15). The project used one bottle of Actellic for the experimental huts study and, with PMI's permission, donated 10 sachets of SS to other PMI VL Project country programs for insecticide resistance tests early in the year. During the investigation of the insecticide pilferage incident, the project recovered the equivalent of 21 SS sachets that

had been decanted into containers. This recovered insecticide is considered as loss as it cannot be used for IRS due to possible contamination

The closing stock of insecticide after the 2019 campaign has 4,148 bottles of Actellic manufactured in January 2019 with a shelf life of two years and 5,687 sachets of SS manufactured in June 2018 that expire in June 2021.

TABLE 15. POST SPRAY INVENTORY RECONCILIATION 2019

Insecticide	Opening Stock	Procured Stock	Stock for Spray	Quantity Used	Damaged/ Loss/Other	After Campaign Stock
Actellic 300CS	11,100	26,832	37,932	33,783	1	4,148
SumiShield 50WG	376	38,292	38,668	32,950	31	5,687
Total	11,476	65,124	76,600	66,733	32	9,835

II. CHALLENGES AND RECOMMENDATIONS

Overall, the 2019 spray campaign went well and was successful at achieving its targets. Nevertheless, it encountered several challenges during the operations. Based on the lessons it learned from dealing with these challenges, the team made recommendations for future campaigns.

II.1 CHALLENGES

1. Protracted ethnic conflict forced VL Ghana to cancel 2019 IRS operations in CHD. The violence erupted after the project had completed almost all preparations including insecticide procurement, door-to-door mobilization, worker recruitment, infrastructure set-up, and materials' dispatch. For 2020, the project will conduct a thorough geo-political analysis, as well as the usual epidemiological one, to identify another potential district for IRS expansion.
2. The project encountered locked structures and refusals during the campaign. The most common reasons for the locked structures were that occupants had moved to southern Ghana for farm work or other seasonal employment. Reasons for refusals included residents' claims of insecticide stains on walls and insecticide odor or lack thereof. These reasons came mostly from male youths and those living in peri-urban areas. Other reasons included rumors that SS attracted other insects mostly to local poultry. This belief arose in MMD, and three communities there recorded low spray output during the first spray visits. Coverage improved upon revisits, following a meeting the project held jointly with an officer from the district agriculture office.
3. In 2018, a company that buys shea nuts in GUD and KAD depressed IRS acceptance in Nyengbolo (KAD) by spreading the story that nut exporters would not buy nuts from sprayed communities.
4. As in previous campaigns, chiefs and other community and political leaders interfered with SOP recruitment. They used recruitment of their people as a condition of accepting IRS in the communities.
5. Although the project made significant changes in recruiting and training to ensure that TLs would be strong and accountable leaders of their teams, TLs and supervisors needed frequent feedback and reminders to ensure the SOPs were following all procedures while working in communities.
6. Having fewer FSs affected supervision in some operations sites. In particular, some MSP sites could not get a dedicated FS, which left supervision and site management in the hands of TLs. This limited supervision resulted in low spray output and compliance issues.
7. Household preparation continues to be a challenge mainly in peri-urban communities, where residents have more possessions and are generally home less often due to work commitments. Some residents refused to do the preparations because of the burden of packing out and packing in after IRS. The project had to hire packers for several days in all districts, which increased operating costs.
8. Private developers' encroachment on land near operations sites is a problem in EMD, KUD, and YND and will likely become one in sites elsewhere, making them non-compliant with PSECA safety and security requirements. Since 2018, the project stopped storing insecticides in Dalun (KUD) and Sakogu and Langbeni (EMD) sites because the new residences and water sources were getting too close to the sites. This forced the daily transport of insecticides to those sites, which delayed spray team departures to the field.
9. The project switched from data capture by compound to data capture by structure, which increased the volume of SOP cards arriving at the district data centers. Although the project prepared for the

increase by hiring more DEAs, the number of DEAs was not enough to keep the 24-hour data entry and reporting turnaround.

10. For the new data capture by structure, the project adopted the practice of numbering each structure and marking whether it was sprayed or not. The time the project allocated to this and the overall new data capture process during the SOP training was not sufficient for the trainees to fully embrace and practice the protocol.

11.2 RECOMMENDATIONS

1. The project started IRS on April 2, earlier than previously, and it worked well to avoid major rains and holidays. The earlier start of the 2019 IRS campaign helped avoid the peak of shea nut-picking season and minimize refusals in misinformed shea nut communities. The project plans to start the spray campaign early to leverage spray coverage in those communities and avoid rain and holidays
2. This year, the project used health volunteers as community mobilizers regardless of their literacy level. (Last year, the project had to move around more literate mobilizers to do enumeration as part of door-to-door outreach.) This enhanced commitment of the mobilizers to properly prepare the communities and improve acceptance of IRS. The project will continue to engage mobilizers in communities where they are well known and can make an impact on IRS acceptance.
3. The project will start community engagement early to intensify SBC. Communities and their leadership will be fully engaged in all SBC activities to find sustainable solutions to the issues of locked structures, maintaining spray surfaces against the vector (no painting after spray, few wall hangings, etc.). Detailed information at the structure level on reasons why structures were not sprayed helped the project focus attention on locked structures and refusals, and work on targeted messages to address these reasons.
4. Despite interference in SOP recruitment by chiefs and political leaders, VL Ghana will continue to recruit based on merit and required selection criteria. It will continue engaging with government partners and stakeholders during recruitment so that they have a better appreciation of the system.
5. To mitigate pilferage, the project introduced a requirement for a guarantor for all seasonal workers who would access insecticide during the 2019 campaign. Each worker had to provide the name, signature, and contact information of two local or religious leaders or other prominent people in the community at the time of signing the work agreement. This may have helped reduce thefts to only one case in 2019. The project plans to require a guarantor as a condition for employment. Immediate remedial action shall be non-payment of any of the perpetrator's outstanding wages and listing the perpetrator as ineligible for rehire in future IRS campaigns. Police reports shall be filed, as required.
6. The project will consider either reducing the number of MSP stand-alone operations sites or increasing number of supervisors at those sites. It will continue to do thorough supervision and monitoring of these sites during and after spray campaigns. To address homeowner preparation for spraying in peri-urban communities, the project will continue hiring packers and stationing some spray teams in the communities for the entirety of the campaign. This was done in eight towns this year.
7. To avoid encroachment on operations sites by developers, the project will consider relocating affected sites to areas that meet our Best Management Practice standards for future campaigns.
8. Integrating IRS outreach into the routine health promotion messages of CHNs was successful. However, the project needs to include more (if possible, all) CHNs in IRS districts to ensure they encourage all communities to accept IRS.
9. The project will consider introducing an SMS- or mobile-based performance tracking tool to give project leaders, site managers, and others access to raw spray data results across all sites within 24 hours.

ANNEX A. POST-SPRAY INVENTORY OF KEY IRS SUPPLIES

Item Description	UOM	Balance Before	Quantity Procured	Total	Quantity Used	Quantity Damaged/ Bad	Quantity After Campaign
INSECTICIDE							
Actellic 300CS	Bottle	11,100	26,832	37,932	33,783	1 ⁴	4,148
SumiShield 50WG	Sachets	376	38,292	38,668	32,950	31 ⁵	5,687
PPE							
Coverall	Pcs	1744	296	2040	1870	104	1936
Face Shield	Pcs	1091	750	1841	1312	1312	529
Hand Gloves	Pair	1180	750	1930	1409	1409	521
Hard Hat	Pcs	729	224	953	953	73	880
Head Gear	Pcs	896	50	946	946	40	906
Heavy Duty Gloves	Pair	16	288	304	1701	170	134
Nose Mask	Pcs	1550	32880	34430	32615	32615	1815
GOIZPER PUMP & ACCESSORIES							
Goizper 1k Super Pump (10 Ltrs)	Pcs	665	103	768	714	0	768
Check Valve (chamber Valve)	Pcs	72	0	72	8	0	80
1k Super Service Kit	Set	48	0	48	46	0	2
Lance Tube	Pcs	17	22	39	24	0	15
Plunger	Pcs	11	181	192	81	0	111
Pressure Regulator (Cfv)	Pcs	64	0	64	3	0	61
Nozzle Filter	Pcs	900	636	1536	511	0	1011
Nozzle Protector	Pcs	50	0	50	27	0	31
Nozzle Tip	Pcs	1476	0	1476	490	0	1342
Safety Valve	Pcs	50	0	50	17	0	81
Tighten Chamber Tool	Pcs	7	18	24	0	0	25
PPES							
Apron	Pcs	122	44	166	152	28	138

⁴ One bottle used for the experimental huts study early in the year.

⁵ Equivalent of 21 sachets were pilfered and recovered; 10 sachets to be shared with other country programs for insecticide resistance tests.

Item Description	UOM	Balance Before	Quantity Procured	Total	Quantity Used	Quantity Damaged/ Bad	Quantity After Campaign
Boot	Pair	915	166	1081	1064	294	787
Cotton Socks	Pair	28	1846	1874	1706	1706	168
Neck Cover	Pcs	1455	390	1845	1662	30	1815

REUSABLES

Bathing Bucket	Pcs	59	46	105	93	16	89
Danger Sign	Pcs	117	22	139	137		152
Fire Extinguisher	Pcs	55	12	67	62	0	67
Flash Light	Pcs	149	627	776	670	377	399
Handwash Bowl	Pcs	49	5	54	54	10	44
Head Lamp	Set	0	45	45	44	2	42
Heavy Duty Brush	Pcs	26	90	116	67	49	67
Megaphone	Pcs	23	29	52	46	3	49
Mobilizers Vest	Pcs	745	699	1444	1132	0	982 ⁶
Public Address System	Set	14	3	17	15	0	17
Rinsing Barrels	Pcs	166	40	206	192	3	203
Spray Bag	Pcs	773	168	941	839	191	750
Spread Sheet	Pcs	147	1697	1844	1632	1609	235

CONSUMABLES

Atropine Inj (1 Ampl)	Pcs	40	280	320	320 ⁷	0	0
Bar Soap (Key Soap)	Pcs	30	816	846	763	0	83
Bathing Soap (Geisha)	Pcs	53	2808	2861	2641	0	220
Batteries (Dry Cell)	Pair	485	2592	3077	2415	0	662
Chalk	Pck	3590	0	3590	606	0	2984
Empty Sack	Pcs	126	174	300	285	0	15
First Aid Kit	Set	14	118	132	69	0	63
Powdered Soap (Omo)	Sachet	85	920	1005	887	0	118
Sanitary Pad	Set	190	496	686	596	0	90

⁶ 526 yet to be retrieved.

⁷ VL Ghana purchased atropine using Abt corporate funds and distributed it to the health facilities. No actual use of atropine to treat insecticide exposure occurred.

Item Description	UOM	Balance Before	Quantity Procured	Total	Quantity Used	Quantity Damaged/ Bad	Quantity After Campaign
PRINT MATERIALS							
Daily Spray Operator Card	Pcs	3375	57000	60375	50158	3375	6842
Daily TL Form	Pcs	286	8200	8486	5878	286	2322
DOS Form	Pcs	638	7100	7738	6408	638	692
IRS Steps Poster	Pcs	0	5000	5000	3984	0	1016
Spray Calendar	Pcs	0	8000	8000	6589	0	1411
HH No. Plate & Sticker	Pair	6517	8400	14917	12306	0	2611
MOI Card	Pcs	565	2800	3365	2208	0	1157
MSDS	Set	45	18	63	19	0	44
Performance Tracker	Pcs	0	26	26	26	0	0
Anti-Sexual Harassment Poster	Pcs	23	11	34	13	0	21
Spill Response Procedure	Set	42	5	47	47	10	37
"Well-dressed" Storekeeper Poster	Pcs	0	25	25	23	0	25
MOBILE PHONE FOR IRS FIELD REPORTING							
Samsung Ch@T 222	Pcs	5	0	5	0	0	5
Huawei Y3	Pcs	10	0	10	10	0	10
Huawei Y5	Pcs	64	0	64	64	0	64
Samsung Galaxy J2 core	Pcs	0	14	14	14	0	14

ANNEX B: SPRAY CAMPAIGN SUPERVISORY TOOLS

Supervisory Tool	Purpose and Person Responsible
Spray Operator Morning Mobilization	<p>To ensure that the spray teams report to work on time, check SOP health status, check full PPE worn, collection of leftover insecticides, etc.</p> <p>The persons responsible include: Site Managers, DOCs, ECO, COP, and Operations Manager.</p>
Spray Operator Transportation Vehicle Inspection	<p>To ensure that vehicle condition and observe spray teams' compliance when boarding vehicle e.g., pump handling.</p> <p>The persons responsible include: Site Managers, DOCs, ECO, COP, and Operations Manager.</p>
End-of-Day Clean-up	<p>To ensure all SOPs observe all EC protocols and properly clean spray equipment, and account for all insecticides.</p> <p>The persons responsible include: Operations Manager, COP, ECO, Site Managers, and DOCs</p>
Homeowner Preparations and Spray Operator Performance	<p>To ensure that SOPs observe proper eligible room preparation, correctly handle insecticides, use proper spray techniques, and understand household's education procedures.</p> <p>The persons responsible include: FSs, ECO, COP, Operations Manager, and DOCs (when visiting the field for supervision)</p>
Storekeeper Performance	<p>To supervise and monitor Store Assistants applying best warehousing practices and to account for all inventory and equipment.</p> <p>The persons responsible include: Site Manager, DOC, District Logistics Assistants, Logistics Manager, COP, Operations Manager, and any visiting staff</p>
Data Collection Verification	<p>To ensure that SOPs observe proper data capturing on all eligible structures.</p> <p>The persons responsible include: M&E Manager, COP, Operations Manager, Data Manager, and DOCs (when visiting the field for supervision)</p>
Directly Observed Supervision	<p>To ensure the proper spray technique is used by observing the spray speed, overlapping, cut-off at the bottom, and distance to the wall, all to ensure the correct amount of insecticides is deposited.</p> <p>The persons responsible include TLs and supervisors</p>

ANNEX C: FUMIGANT EFFECT OF SPRAYED INSECTICIDES

TABLE C-1: TOTAL NUMBER OF MOSQUITOES TESTED AND THE PERCENTAGE MORTALITY AFTER 24 HOURS IN TESTS SHOWING AIRBORNE FUMIGANT EFFECT OF PIRIMIPHOS METHYL (ACTELIC 300CS) ON KISUMU STRAIN OF *AN. GAMBIAE*. AND WILD *AN. GAMBIAE* S.L., APRIL 2019.

Test Site	# Tested	% Knock down		% Mortality
		30 mins	60 mins	24 Hrs
Gushegu(GUD)				
<i>An. gambiae</i> , Kisumu Strain	40	10%	63%	100%
Wild <i>An. gambiae</i> s.l.	40	0%	8%	100%
Karaga (KAD)				
<i>An. gambiae</i> , Kisumu Strain	18	16%	71%	100%
Wild <i>An. gambiae</i> s.l.	39	3%	8%	97%
Namong I (YND)				
<i>An. gambiae</i> , Kisumu Strain	20	0%	10%	95%
Wild <i>An. gambiae</i> s.l.	40	0%	10%	98%
Boaterigu (BND)				
Wild <i>An. gambiae</i> s.l.	36	5%	18%	62%
Mbanaa yili (KUD)				
Wild <i>An. gambiae</i> s.l.	40	10%	20%	78%

TABLE C-2: TOTAL NUMBER OF MOSQUITOES TESTED AND THE PERCENTAGE MORTALITY AFTER 24 HOURS IN TESTS SHOWING FUMIGANT EFFECT OF CLOTHIANIDIN (SUMISHIELD 50WG) ON KISUMU STRAIN OF *AN. GAMBIAE*. AND WILD *AN. GAMBIAE* S.L., APRIL 2019.

Test Site	# Tested	% Knock down		% Mortality		
		30 mins	60 mins	Day 1	Day 2	Day 3
Arigu (WMD)						
<i>An. gambiae</i> , Kisumu Strain	20	0%	0%	10%	100%	
Wild <i>An. gambiae</i> s.l.	17	0%	0%	34%	89%	100%
Kunkua (MMD)						
Wild <i>An. gambiae</i> s.l.	29	0%	0%	52%	80%	100%

ANNEX D: 2019 DATA QUALITY ASSURANCE AND CONTROL METHODS

Issue	Method/Tools for Quality Assurance
Mobilization data integrity	<ul style="list-style-type: none"> • Use of standardized data collection forms for mobilization of new compounds • Training of mobilizers for high-quality data capture. • Multiple levels of supervision. • Spot checks at household level • Database designed with locks and validation checks.
Spray data integrity	<ul style="list-style-type: none"> • Use of standardized data collection forms. • Comprehensive training for spray data capture. • Direct supervision of SOPs by TLs. • FSs monitor the TLs and verified SOP forms. • M&E Manager, Database Manager, and District M&E Coordinators monitor and verify data captured by SOPs, TLs, and Supervisors. • Structure spot checks to cross-check daily spray data captured by SOPs. • Database designed with locks and validation checks. • Use of TL and Error Eliminator forms to ensure complete and accurate data collection • Conducts DCV to ensure accuracy of data reported by SOPs. • Use of mobilization dataset to compare compounds sprayed with compounds mobilized to address issues of missed compounds.
Spray data entry and management	<ul style="list-style-type: none"> • Training for all DEAs. • Daily field data entry and transfer into the cloud (Dropbox). • Data entry via double-data-entry method: <ul style="list-style-type: none"> ○ Initial data entry of “totals” data within 12 hours after spray ○ Entry of “details” data (per SOP/structures within 24 hours after spray) • Data scan for irregularities • Use of 4-box approach to ensure all data cards are entered into the database. • Use of Microsoft Access-based IRS Cleaning/Reporting tool to clean data daily.
Data security	<ul style="list-style-type: none"> • Data collection forms printed on durable sheets. • Password-protected database to restrict unauthorized entry. • Databases backed up daily on the server laptop, dropbox, and external drives. • Use of strict filling regime to ensure safe storage of data cards/forms for future reference per data management protocol of the project. • Strict adherence to all data management protocols.

ANNEX E: 2019 PMI VECTORLINK GHANA INDICATOR MATRIX

	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
1.1	Successfully execute IRS and other malaria vector control programs												
1.1.1	Annual country work plan developed and submitted on time	Project records Annually		Completed	Completed	Completed	Completed	Completed		Completed		Completed	
1.1.2	Number of eligible structures targeted for spraying	Project records Annually		324,115 ⁸	324,704 ⁹	324,704 ¹⁰	316,285 ¹¹	TBD		TBD		TBD	
1.1.3	Number of eligible structures sprayed with IRS	Project records Annually		275,498 ¹²	298,701	298,781 (85%) 316,356 (90%) ¹³	298,385	TBD		TBD		TBD	

⁸ Based on structures found during 2017 AIRS spray campaign

⁹ Based on structures found by SOPs in 2018

¹⁰ The initial target of 351,507 was revised to 324,704 because CHD's target of 26,803 was taken out. The 324,507 was the number of structures found in 2018

¹¹ The number was adjusted to remove 1,104 ineligible structures identified as will be locked for more than 6 months

¹² Based on 85% of 1.1.2 target for 2018

¹³ Based on 85% and 90% of 1.1.2 target for 2019

	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.1.4	Percentage of total structures targeted for spraying that were sprayed with a residual insecticide (Spray Coverage PMI and NMCP targets)	Project records Annually		85% (PMI) 90% (NMCP)	92.0%	85% (PMI) 90%(NMC P)	94.3%	85%		85%		85%	
I.1.5	Number of people protected by IRS	Project records Annually	Sex Pregnant women Children <5	874,608 ¹⁴	836,376 18,397 pregnant women 148,627 children <5	956,599 ¹⁵	875,481 (19,844 pregnant women, 157,398 Children <5	TBD		TBD		TBD	
I.1.6	EOSR submitted within 45 days after the end of spray (including completing MEP and EMMR)	Project records Annually		Completed	Completed	Completed	Completed	Completed		Completed		Completed	
I.1.7	Post-spray Data Quality Audit conducted within 90 days of spray completion	Data Collection Forms Annually		N/A	N/A	N/A	N/A	Completed		N/A		Completed	
I.1.8	Number of Insecticide Treated Nets (ITNs) distributed, by channel	Project records Annually	Channel	N/A	N/A	N/A	N/A	TBD		TBD		TBD	

¹⁴ Made up of population protected (840,438) and population not protected (34,170) during the 2017 AIRS spray campaign.

¹⁵ Made up of population protected (836,376) and population not protected (46,196) in structures found during the 2018 VL spray campaign and estimate for CHD (74,027)

	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.1.9	Conducted 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	Channel	N/A	N/A	N/A	N/A	TBD		TBD		TBD	
I.1.10	Operational routine monitoring systems for continuous ITN distribution established and disaggregated by channel	Project records Annually	Channel	N/A	N/A	N/A	N/A	TBD		TBD		TBD	
I.1.11	ITN durability monitoring data collection completed on time as planned in a given project year	Project records Annually		N/A	N/A	Completed	N/A ¹⁶	TBD		TBD		TBD	
I.2	Provide technical assistance and planning support for IRS and other integrated malaria vector control activities												
I.2.1	Number of VC project training workshops targeting NMCP and other host country staff	Project training records Annually	Technical area Job function	N/A		¹⁷	¹⁸	TBD		TBD		TBD	

¹⁶ Durability monitoring activities will begin in July 2019.

¹⁷ Boot camp for IRS technical training

¹⁸ Boot camp for IRS technical training for VL Staff, AGAMal and NMCP in Tamale

	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.2.2	Number of NMCP and other VC host-country staff accessing DHIS2	DHIS2 Logs Annually	job function	N/A	N/A	N/A	N/A	TBD		TBD		TBD	
I.3	Ensure safe and judicious use of insecticides and other malaria vector control products												
I.3.1	Number of VC personnel trained in EC and personal safety standards in VC implementation	Project training records Annually	Sex (# and %) job function	893 ¹⁹	874 ²⁰ 713 male, 161 female	973 ²¹	910 (712 male, 198 female) 21.8% female	TBD		TBD		TBD	
I.3.2	Number of health workers receiving insecticide poisoning case management training	Project training records Annually	Sex (# and %)	42	41 33 males (80.5%); 8 females (19.5%)	53	0	TBD		TBD		TBD	
I.3.3	Number of adverse reactions to pesticide exposure documented	Incident Report Forms Annually	Type of exposure	0	0	0	0	0		0		0	

¹⁹ SOPs (660), Team Leaders (132), Field Supervisors (64), Site Managers (21) Disease Control Officers & DEHOs (14), EPA Rep (2)

²⁰ SOPs (644), Team Leaders (127), Field Supervisors (66), Site Managers (21), DOCs (3), Disease Control Officers (7), DEHOs (5), EPA Rep (1)

²¹ TOT: One DOC (CHD), Disease Control Officers (9), DEHOs (9), Regional Malaria Focal Person (2), Field Supervisors (55), Site Managers (25), EPA and NMCP (2) and Spray Operations Training: Spray Operators, Team Leaders (870).

	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
1.4	Strengthen capacity of NMCPs, vector control personnel, and other institutions to implement and manage IRS and other vector control activities												
1.4.1	Total number of people trained to support VC in targeted areas	Project training records Annually	Sex (# and %) Job function VC intervention Type	856 ²²	837 ²³ 677 male, 160 female	925 ²⁴	864 ²⁵ 676 male (78.2%), 188 female (21.8 %)	TBD		TBD		TBD	
1.4.2	Number of people trained during IRS Training of Trainers	Project training records Annually	Sex (# and %)	106	103; 96 male (93.2%) 7 females (6.8%)	103	103; 88 male (85.4%) 15 female (14.6%)	TBD		TBD		TBD	
1.4.3	Total number of people hired to support VC in target districts	Project records Annually	Sex (# and %) Job function VC intervention Type	2,248 ²⁶	2,447 ²⁷ 2,067 males (84.5%) 380 females (15.5%)	2,865 ²⁸	2,594 ²⁹ 2,125 male, (81.9 %), 469 female (18.1%)	TBD		TBD		TBD	

²² SOPs (660), TLs (132), Field Supervisors (64); IRS only

²³ SOPs (644), TLs (127), Field Supervisors (66); IRS only

²⁴ SOPs (725), TLs (145), Field Supervisors (55); IRS only

²⁵ SOPs (667), TLs (140), Field Supervisors (57) IRS only

²⁶ Refer to indicator 1.4.1 less Government staff (83), buffer(45) Drivers (48) and Security Guards (45)

²⁷ DOCs (3), Data Entry Assistants (23), Finance Assistants (7), IEC Assistants (24), Logistics Assistants (7), Store Assistants (22), Mobilizers (1,143), Security Officers (47), Site Managers (21), SOPs (602), Field Supervisors (63), TL (121), Washers (57), Water Fetchers (20), M&E Assistants (11), Packers (140), Entomology Assistants (136)

²⁸ Total number of people trained (3,185) less Government staff (152), Drivers (53), Security Guards (58), and Buffer (57). [The Buffer (57) is made up of SOP (35), TL (7), FS (5), DEA (4), M&E Assistants (4) and Store Assistants (2)]

²⁹ DOC (1), Data Entry Assistants (34), Finance Assistant (8), M&E Assistants (15), IEC Assistants (26), Logistic Assistants (8), Stores (25), Mobilizers (1169), Security (50), Site Manager (24), SOPs (637), Field Supervisors (50), Team Leaders (126), Washers (66), Water fetchers (11), and Packers (200). Entomology Assistant (144).

	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
1.4.4	Number of government/district officials who acted as supervisors during VC campaigns	Project records Annually	VC intervention Type	43 ³⁰	22 ³¹	47 ³²	27 ³³	TBD		TBD		TBD	
1.5	Promote gender equality in all facets of planning and implementation												
1.5.1	Number of women hired to support VC campaigns	Project records Annually	% of Returning female seasonal workers hired in a more senior capacity	773; 20%	380; 13% ³⁴ 3536	562 ²⁸ ; 20%	469 ³⁷ ; 18.1%	TBD		TBD		TBD	

³⁰ District Information Officers (7), District Communication/Health Promotion Officers (7), District Entomology Team (5), DEHOs (7), District Store Officers (7), Disease Control Officers (7), EPA-national (1), National Malaria Control (1) and GHS Regional Directorate (1).

³¹ DEHOs (6), EMD DEHO did not work, Disease Control Officer (IRS and Entomological Supervision; 7), Environmental Protection Agency (1), District Communication/Health Promotion Officers (7) and Community Health Nurse (Entomological Supervision; 1).

³² District Information Officers (9), District Health Promotion Officers (9), District Environmental Health Officers (9), District Supply Officers (9), Disease Control Officers (9), EPA-national (1), National Malaria Control (1).

³³ District Health Promotion Officers (8), District Environmental Health Officers (8), Disease Control Officers (8), Regional Health Promotion Officer (1) and National Malaria Control Program (2)

³⁴ Hired in a more senior capacity: 11 SOPs to TLs, one DEA to M&E Assistant, and one Store Assistant to Logistic Assistant.

³⁵ % of Indicator 1.4.3.

³⁶ % of total anticipated supervisors. Total expected for supervisory role is 256 (District Operations Coordinators 7, Information, Education Communication Assists 24, Team Leaders 120, M&E Assistants 11, Field Supervisors 66, Logistics Assistants 7 and Site Managers 21).

³⁷ Refer to indicator 1.4.3

	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
1.5.2	Number and percentage of women hired in supervisory roles in target areas for VC activities	Project Records Annually	VC intervention type Job function	51 ²⁹ ; 16%	36 ³⁸ 39; 14.2%	54 ³¹ ; 20%	54 ⁴⁰ ; 21.0%	TBD		TBD		TBD	
1.5.3	Number and percentage of staff (permanent and seasonal) who have completed gender awareness training	Project training records Annually	Sex Job function	864 ⁴¹ ; 100%	874 ⁴² 713 males (81.6%) 161 females (18.4%)	993 ⁴³ ; 100%	910 ⁴⁴ 712 males (78.2%) 198 females, (21.8%)	TBD; 100%		TBD; 100%		TBD; 100%	
1.5.4	Number and percentage of women in senior leadership roles in VectorLink country offices	Project records Annually	Sex (# and %)	N/A	N/A	N/A	1	N/A		N/A		N/A	

³⁸ DOC (1), M&E Assistant (1), IEC Assistants (2), TLs (25), Field Supervisors (5), Logistic Assistant (2); Total Supervisors hired (254).

³⁹ % of total anticipated supervisors. Total expected for supervisory role is 271 (DOCs 8, IEC Assistants 26, Team Leaders 138, M&E Assistants 16, Field Supervisors 50, Logistics Assistants 8 and Site Managers 25).

⁴⁰ DOC (1), M&E and DCV Assistants (2), IEC Assistants (5), Team Leaders (33), Logistic Assistant (1), Field Supervisor (5), Site Manager (7).

⁴¹ For TOT, TL and SOP trainings

⁴² DOCs (3), Disease Control Officers (7), DEHOs (5), EPA Rep. (1), Field Supervisors (66), Site Managers (21), TLs (127), and SOPs (644)

⁴³ DOCs (1), Disease Control Officers (9), DEHOs (9), EPA Rep. (1), Malaria Focal Persons (2), NMCP (1), Field Supervisors (55), Site Managers (25), TLs (145), and SOPs (745)

⁴⁴ DOC (1), Disease Control Officers (9), DEHOs (9), FS (57), SM (27), SOP (667), TL (140)

	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	Implement and support social behavioral change communication and mobilization activities												
1.6.1	Number of radio spots and talk shows aired	Project records Annually	VC intervention Type	900	840	1,086 (630 spots, 36 radio discussions, 420 radio messages)	1,446 (990 spots, 36 Interactive talk shows, 420 radio messages)	TBD		TBD		TBD	
1.6.2	Number of print materials disseminated	Project records Annually	VC intervention Type	4,000 ⁴⁵	8,000 ⁴⁶	18,400 ⁴⁷	12,382	TBD		TBD		TBD	
1.6.3	Number of people reached with VC and/or SBCC messages via door-to-door messaging	Project records Annually	VC intervention Type Sex	437,304 ⁴⁸	274,055 121,672 males (44.4%) 152,383 females (55.6%)	48,791 ⁴⁹	32,476 ⁵⁰ 15,170 male (46.7%), 17,306 female (53.3%)	TBD		TBD		TBD	
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		N/A	N/A	N/A	N/A	TBD		TBD		TBD	

⁴⁵ For IRS only

⁴⁶ For IRS only

⁴⁷ The print materials are disaggregated as follows: 5000 malaria free posters/spray calendars, 5000 IRS steps posters, 8,400 brochures

⁴⁸ Targeting 50% of population found (ref indicator 1.1.5) in 2017

⁴⁹ Target for Indicator 1.6.3 is made up of 11,777, which is 50% of people living in locked and refusal structures found in 7 districts in 2018 and 37,014, which 50% of estimated population living in the structures in CHD to be reached during house to house mobilization.

⁵⁰ This includes 24,658 persons (11,416 males and 13,242 females) in Chereponi and 7,818 (3,754 male and 4,064 female) in difficult communities in the rest of the districts.

	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
1.6.5	Number and percentage of people with a favorable attitude toward the practice/product (i.e., ITNs, IRS)	Project records Annually	VC intervention Type	N/A	N/A	N/A	N/A	TBD		TBD		TBD	
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	VC intervention Type	N/A	N/A	N/A	N/A	TBD		TBD		TBD	
1.7	Environmental compliance												
1.7.1	SEA (with EMMPs) or Letter Report submitted at least 60 days prior to the commencement of VC campaigns	Project records Annually		Completed	Completed	Completed	Completed	Completed		Completed		Completed	
1.7.2	Number and percentage of permanent and mobile soak pits inspected and approved prior to IRS campaigns	Project records Annually	Soak Pit Type	39; 100% PSP: 22 ⁵¹ ; MSP: 17 ⁵²	39;100% PSP: 22 MSP: 17	41; 100% PSP: 28 MSP: 13	51:107% PSP: 27 MSP: 17	TBD; 100%		TBD; 100%		TBD; 100%	

⁵¹ Permanent Soak Pits (PSP), one in each operational site; one temporary soak pit at Sandua camping site (KAD).

⁵² BYD (1), EMD (4), WMD (3), MMD (1), KD (Singa camping site; 5), GD (1) and KAD (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
1.7.3	Number and percentage of storehouses inspected and approved prior to IRS campaigns	Project records Annually	Storehouse Type	22 ⁵³ ; 100%	22;100%	26 ⁵⁴ ;100%	26	TBD; 100%		TBD; 100%		TBD; 100%	
1.7.4	Number and percentage of fixed soak pits that are compliant with PMI's Best Management Practices	Project records Annually		22 ⁵⁵ ; 100%	22;100%	28; 100%	27 ⁵⁶ ; 100%	TBD; 100%		TBD; 100%		TBD; 100%	
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, seasonality, feeding time, and location)	Entomological Reports Annually	VC Intervention Type	20; 100%	20 ⁵⁷ ; 100%	16 ⁵⁸ ; 100%	16;100%	TBD; 100%		TBD; 100%		TBD; 100%	

⁵³ Stores in all operations sites plus 1 Sandua (KAD) camping site store.

⁵⁴ Stores in all operations sites: BYD (5), CHD (2) EMD (5), GUD (4) KAD (3) KUD (2) MMD (2), and WMD (3).

⁵⁵ Refer to Indicator 1.7.2.

⁵⁶ 28 fixed soak pits were targeted to be inspected and used. Additional one was constructed at Zanteli (GUD). However, two soak pits in Chereponi were not used due to the conflict. Hence 27 soak pits were used during the 2019 campaign

⁵⁷ For IRS only. Data collection is being conducted across all the 20 sites and will end in December 2018.

⁵⁸ Revised number of sentinel sites is 16 for 2019.

	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
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 and location)	Entomological Reports Annually	VC Intervention	7 ⁵⁹ ; 35%	7 ⁶⁰ ; 35%	4 ⁶¹ ; 25%	4 25%	TBD		TBD;		TBD	

⁵⁹ For IRS only; 7 out of the total 20 sites will measure all five basic PMI entomological indicators

⁶⁰ Data collection to end at the end of December 2018

⁶¹ For IRS only; 4 out of the total 16 sites will measure all five basic PMI entomological indicators

	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
2.1.3	Number and percentage of entomological monitoring sentinel sites measuring at least one advanced PMI indicator (i.e., identification of mosquito infectivity; parity rates; or bloodmeal analysis)	Entomological Reports Annually	VC Intervention	20; 100%	20; 100%	16; 100%	16; 100%	TBD; 100%		TBD; 100%		TBD; 100%	
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	Insecticide Type	14; 100%	9; 64%	14; 100%	0; 0% Tests started late May (beginning of the rainy season)	TBD; 100%		TBD; 100%		TBD; 100%	
2.1.5	Number of wall bioassays conducted within 2 weeks of spraying to evaluate the quality of IRS	Entomological Reports Annually		56	72 ⁶²	56	56	TBD		TBD		TBD	

⁶² Completed between April-June

	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
2.1.6	Number and percentage of cone bioassays conducted within two weeks of spraying with greater than 98% test mortality recorded	Entomological Reports Annually		56 ⁶³ :100%;	72; 100%	56; 100%	55:98%	TBD		TBD		TBD	
2.1.7	Number of wall bioassays conducted after the completion of spraying at monthly intervals to evaluate insecticide decay	Entomological Reports Annually	Insecticide Type	224 ⁶⁴	168 ⁶⁵	128 ⁶⁶	24 ⁶⁷	TBD		TBD		TBD	
2.1.8	Number of vector susceptibility tests for different insecticides conducted in selected sentinel sites	Entomological Reports Annually	Insecticide Type	56 ⁶⁸	62 ⁶⁹	60	4 ⁷⁰	TBD		TBD		TBD	
2.1.9	Integrated VC analytics dashboard available for decision making	Project records Annually		N/A	N/A	N/A	N/A	TBD		TBD		TBD	

⁶³ Refer to Indicator 2.1.5

⁶⁴ Communities, 4 test per community for 8 months (7x4x8).

⁶⁵ Number of conducted tests as of September 30, 2018; testing is ongoing at the time of report submission. 5 months test done so far.

⁶⁶ Communities, 4 test per community for 8 months (4x4x8).

⁶⁷ Only 1 month of bioassay done for 3 sentinel sites so far. Tests will be done monthly until December or the residual life of sprayed insecticides drops below 80%.

⁶⁸ 14 sites, 4 tests per site, one insecticide per each of four classes.

⁶⁹ Alpha-cypermethrin 0.05% (16), 1 bendiocarb 0.1% (12), clothianidin 90.5µg (11), DDT (5), and pirimiphos-methyl 0.25% (18).

⁷⁰ Insecticide papers were only delivered in June 2018 from USM. Results will be revised at a later date.

	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
2.1.10	Number of staff (VectorLink-contracted or non-VectorLink) trained in entomological monitoring	Project training records Annually	Sex (# and %) Job function	80 ⁷¹	74 ⁷² 71 males (95.9%) 3 females (4.1%)	20 ⁷³	0	TBD		TBD		TBD	
2.2	NMCPs develop country-level IRS and other malaria vector control strategies												
2.2.1	Developed an integrated malaria VC strategy, including a plan for monitoring and managing insecticide resistance supported by the project	Project records Annually		N/A ⁷⁴	N/A	N/A	N/A	TBD		TBD		TBD	
2.2.2	Completed integrated data and visualization landscaping for VC decision making	Project records Annually		N/A	N/A	N/A	N/A	TBD		TBD		TBD	
2.2.3	Implemented sub-national insecticide rotation as part of an IRM strategy	Project records Annually		N/A	Complete	Completed	Completed ⁷⁵	TBD		TBD		TBD	

⁷¹ Non-project staff.

⁷² Entomology data collectors (74).

⁷³ Mosquito collectors to be trained in new sentinel sites in CHD.

⁷⁴ Target amended as the NMCP is undertaking this work directly with the WHO, and VectorLink is not tasked with contributing. Expectations of VectorLink are to follow up on progress and remind relevant parties of completion.

⁷⁵ VL Ghana sprayed three districts with clothianidin and five with pirimiphos-methyl

	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
2.3	<i>Build capacity of NMCPs and local institutions to collect, analyze, and use data for strategic malaria control decision-making</i>												
2.3.1	Number of individuals trained from NMCPs and national institutions to review and interpret data for integrated VC decision making	Project training records Annually	Job function Organization	N/A	N/A	N/A	N/A	TBD		TBD		TBD	
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	Job function Organization	N/A	N/A	N/A	N/A	TBD		TBD		TBD	
3.1	<i>Cost-effective procurement mechanism established</i>												
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	Insecticide type	1; 100%	1; 100%	2 ⁷⁶ ; 100%	2; 100%	TBD; 100%		TBD; 100%		TBD; 100%	

⁷⁶ 1 for SumiShield 50WG and 1 for Actellic CS300

	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
3.1.2	Number and percentage of insecticide procurements received on-time to allow for the initiation of spray operations as scheduled	Procurement records Annually	Insecticide type	3 ⁷⁷ : 100%	1 ⁷⁸ :33.3%	2 ⁷⁹ : 100%	2:100%	TBD; 100%		TBD; 100%		TBD; 100%	
3.1.3	Number and percentage of international equipment procurements, including PPE, received on time to allow for the initiation of VC campaigns as scheduled	Procurement records Annually	VC intervention Type	2 ⁸⁰ : 100%	3 ⁸¹ :100%	2 ⁸² : 100%	3 ⁸³ :150%	TBD; 100%		TBD; 100%		TBD; 100%	

⁷⁷ 1 procurement (Actellic CS300) arriving in two shipments; 1 donation (i.e., not procured by VectorLink Ghana) of SumiShield 50WG

⁷⁸ 1 shipment of Actellic CS300 arrived on time to allow for the initiation of VL campaign. 2nd shipment of Actellic CS300 and SumiShield 50WG arrived during the course of the campaign

⁷⁹ 1 for SumiShield 50WG and 1 for Actellic CS300

⁸⁰ IRS only; Goizper (1), PPE (1)

⁸¹ IRS only; Goizper pump and Accessories (1), PPE (1) and Activated Charcoal (1)

⁸² PPE (1), Goizper pump and spare parts (1)

⁸³ PPE (1), Goizper pump and parts (1) and first aid kits (1)

	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
3.1.4	Number and percentage of local procurements for PPE received on time to allow for the initiation of spray operations as scheduled	Procurement records Annually		4 ⁸⁴ ; 100%	4;100%	4 ⁸⁵ ; 100%	4:100%	TBD; 100%		TBD; 100%		TBD; 100%	
3.1.5	PPE procured according to workforce composition	Procurement records Annually		N/A	N/A	Completed	Completed	Completed		Completed		Completed	
3.2	Robust inventory management and logistics systems established												
3.2.1	Number and percentage of logistics and warehouse managers trained in VC supply chain management	Project training records Annually	VC intervention Type Sex (# & %)	31 ⁸⁶ ; 100%	31 ⁷⁵ ; 100% 12 males (38.7%) 19 females (61.3%)	36; 100%	36 ⁸⁷ :100% 12 males (33.3%) 24 females (66.7%)	TBD; 100%		TBD; 100%		TBD; 100%	
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	Insecticide type	22 ⁸⁸ ; 100%	22; 100%	26; 100%	26;100%	TBD; 100%		TBD; 100%		TBD; 100%	

⁸⁴ Rubber boot (1), neck cover (1), apron (1) and cotton socks (1).

⁸⁵ Apron (1), cotton socks (1), neck cover (1) and rubber boot (1).

⁸⁶ IRS only; Store Assistants (24) and Logistics Assistants (7). SumiShield 50WG was stored at the 2 MMD stores. Actellic was stored in the rest of the 20 stores

⁷⁵ Logistics Assistant 7 (female 2), Store Assistant 24 (female 17).

⁸⁷ Logistics Assistant 8 (female 1), Store Assistant 28 (female 23)

⁸⁸ Actellic 300 CS (20); Sumishield 50WG (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
3.2.3	Successfully completed spray operations without an insecticide stock-out	Inventory and stock records Annually	Insecticide type	Completed	Completed	Completed	Completed	Completed		Completed		Completed	
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	⁸⁹		⁹⁰	⁹¹	TBD		TBD		TBD	
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 other partners or international institutions for global reporting on the Vector Learning Exchange	Project records Annually	Technical area	⁹²	⁹³	⁹⁴	TBD ⁹⁵	TBD		TBD		TBD	

⁸⁹ CORE-funded operational research on partial spraying of wall surfaces

⁹⁰ Entomology Unit is conducting an operational research on effect of IRS on *Anopheles* vector behaviors and their impact on malaria transmission in the northern Ghana.

⁹¹ Partial spraying study

⁹² SBC

⁹³ Presentation of the project SBC-driven impact on acceptance of IRS at the International SBCC summit at Indonesia in April 2018

⁹⁴ A provisional plan to report a success story on e-introduction of IRS to CHD.

⁹⁵ VectorLink Ghana hopes to share a story on a headlamp pilot that was conducted in 2019.

	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
4.2.2	Number of individual members who use the Vector Learning Exchange	Project records Annually	N/A	3	3	4	4	TBD		TBD		TBD	
4.2.3	Number of symposia and/or presentations submitted to and accepted at global conferences	Project records Annually	Technical area	1	1 ⁹⁶	1 ⁹⁷	2 ⁹⁸	TBD		TBD		TBD	
4.2.4	Number of success stories written or videos produced and shared on the VectorLink project website	Project records Annually		1	1 (success story on website) 1 (video in progress)	1	TBD	TBD		TBD		TBD	
4.2.5	Number of peer reviewed journal articles submitted and accepted	Project records Annually	Technical area	0	0	0	0	TBD		TBD		TBD	
4.2.6	Number of critical guidance, standards, or plans that incorporate disseminated findings/best practices	Project records Annually	Technical area	N/A	N/A	N/A	N/A	TBD		TBD		TBD	

⁹⁶ PAMCA (entomology) abstract accepted and presented

⁹⁷ An abstract to be submitted for 2019 ASTMH

⁹⁸ Two abstracts have been submitted but acceptance status is not known at this time.

	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
4.3	<i>Develop and deploy cost-savings approaches</i>												
4.3.1	Number of innovative or novel approaches implemented to achieve cost savings in IRS and integrated malaria VC programs	Project records Annually	VC intervention Type	⁹⁹	¹⁰⁰		¹⁰¹	TBD		TBD		TBD	
4.3.2	Contribute to annual project cost effectiveness assessment of existing approaches in the implementation of IRS and integrated malaria VC programs	Project records Annually	VC intervention Type	Complete d	Complete d	Complete d	Complete d	TBD		TBD		TBD	
4.4	<i>Cultivate public-private partnerships</i>												
4.4.1	Number of private sector entities engaged with to establish public-private partnerships to increase the quality and coverage of malaria VC activities globally	Project records Annually	Private sector organization	0	0	0	0	TBD		TBD		TBD	

⁹⁹ IRS only

¹⁰⁰ One-time in project lifetime installation of a metal plate with IRS identification number at each targeted household

¹⁰¹ Completed procurement of motorbikes for SBC assistants that will last for the life of the project and generate savings in a long term as compared to annual rental.

ANNEX F: IRS 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.	Pre-contract inspection and certification of vehicles for the 2019 spray campaign was conducted on April 21-23, 2019. All 49 vehicles contracted met all pre-contract criteria. Drivers' documents were also inspected to ensure that they met all requirements. All vehicles and drivers were certified.	No outstanding issues	
Ib. Driver orientation	The project held an orientation for all the 49 contract drivers for the rented vehicles in Tamale on March 30-31, 2019. The orientation covered topics such as the driver's responsibility, and Abt Policy on Motor Vehicle Usage. The practical session involved spill response procedures and proper use of the vehicle log sheet.	No outstanding issues	VL Ghana certificated all the 49 contract drivers and engaged them for the 30 days spray campaign.
Ic. Cell phone, personal protective equipment (PPE) and spill kits on board during pesticide transportation.	All 49 drivers had cell phones as a prerequisite for renting their vehicles. The drivers were given a set of PPE after the orientation to be used when transporting insecticides. Each vehicle was equipped with a spill response kit. Out of 47 SOP Transportation Vehicle Inspections conducted during the 2019 spray campaign, there were only 3 instances of non-compliance. Corrective actions were taken before the vehicles were dispatched to the field.	No outstanding issues	Spill response kits, PPE, incident report forms, and Material Safety Data Sheet (MSDS) were provided after the orientation and certification. Missing items were replaced prior to the vehicle being dispatched to the field. All drivers signed the Abt Policy on Motor Vehicle usage during campaign and copies were kept in the vehicles throughout the 30 days.
I d. Initial and 30-day pregnancy testing for female candidates for jobs with potential pesticide contact.	On March 11-14, 2019, prior to recruiting SOPs, the project conducted pregnancy tests for 273 female candidates for the positions of SOP, washer, and TL in eight districts. The project conducted second pregnancy tests on April 26, 2019, in all the districts.	No outstanding issue	The second pregnancy test was conducted and the seven females who tested positive were re-assigned to other activities that had no interactions with insecticide. The results of the second test are on record and are available.

Mitigation Measure	Status of Mitigation Measures	Outstanding issues relating to required conditions	Remarks
I e. Health fitness testing for all operators.	Passing a general physical fitness and medical examination is required for spray personnel. All potential candidates went through such examinations on March 11-14, 2019. Of the 848 candidates examined, 6 did not pass the exam and were declared unfit to attend training. The medical examination records are available on file.	No outstanding issue	The medical examinations were conducted by trained Medical Assistants from government health facilities in all eight IRS districts.
I f. Procurement of, distribution to, and training on the use of PPE for all workers with potential pesticide contact.	Both international and local procurements for PPE were done on time. The PPE were received and distributed to all operations sites on March 11-15, 2019, prior to the start of spray. Also, all candidates with potential pesticides contact were completely trained on correct use of PPE and were subsequently given a complete set of PPE for use throughout the spray campaign.	No outstanding issues	The project conducted training for the Logistics and Storekeeper on the use of PPE in handling pesticide before hiring: 27 storekeepers, 8 logistics assistants, 134 TLs, 57 FSs, 26 Site Managers, and 672 SOPs. An orientation was given to the 49 contract drivers and 69 washers. All these cadres had some contact with insecticides and were provided with a complete set of PPE and trained on its use.
I g. Training on mixing pesticides and the proper use and maintenance of spray pumps.	At the TOT and SOP trainings, participants (DOCs, Supervisors, Site Managers, TLs, SOPs, and government official) were trained on appropriate mixing of SumiShield 50VWG and triple rinse of Actellic 300 CS bottles. The facilitators demonstrated the proper use and maintenance of spray pumps.	No outstanding issue	VL Ghana trained 103 people (DOCs, DEHOs, Site Managers and Supervisors, and Disease Control Officers) at the TOT, and 672 at SOP and TL training on how to mix pesticides and maintain spray pumps.
I h. Provision of adequate facilities and supplies for end-of-day cleanup.	All 24 operations sites including the temporary site (Kpatinga) had adequate storage facilities that were either provided by District Assemblies or rented from an individual. Of all 183 end-of-day inspections of facilities, only 9 incidents of non-compliance were reported.	Kpatinga site is recommended for permanent site status in 2020.	All facilities were inspected and met PMI Best Management Practice (BMP) standards prior to the start of the spray campaign.
I i. Enforce spray and clean-up procedures.	All supervisors and Site Managers supervised end-of-day clean-up procedures throughout the spray campaign. Supervisors and TLs ensured that their teams washed up at the end of each day. Out of 183 end-of-day inspections conducted, there were only 9 instances of non-compliance issues being raised.	No outstanding issues	The COP, Operations Manager, ECO, DOCs, and Site Managers supervised clean-up procedures daily throughout the campaign.

Mitigation Measure	Status of Mitigation Measures	Outstanding issues relating to required conditions	Remarks
2a. SBC campaigns to inform homeowners of responsibilities and precautions.	Prior to the start of spray campaign, SBC Assistants sensitized communities and households to their roles and responsibilities and the precautions they need to take, using door-to-door mobilization, community meetings, radio discussions, and jingles. Community mobilizers, some selected CHNs, and SOPs were trained to inform homeowners about their roles and responsibilities before, during, and after spray, and protocols for household safety.	No outstanding issues	Mobilizers reminded homeowners about their responsibilities and precautions. Few households did not know some of the post-spray requirements. These issues were adequately addressed by the supervisors.
2b. Prohibition of spraying houses those are not properly prepared.	The 2019 trainings emphasized the importance of well-prepared rooms and spray technique. With the introduction of DOS, TLs increased inspections of structures before spraying was done. VL Ghana team also helped to ensure proper preparation of structures before spraying through supervision and physical spot checks. Corrective measures were taken on unprepared rooms. SOPs were given two plastic spread sheets to cover bulky items that could not be moved out.	No outstanding issues	A total of 437 inspections of homeowner preparation and SOP performance were conducted. Inspectors observed only 17 instances where items on the walls or the ceiling were still hanging. These were corrected before spraying was conducted.
2c. Two-hour exclusion from house after spraying.	The SOPs reminded households to wait two hours after spraying before opening the rooms, and for circulation of air for at least 30 minutes before cleaning. Again, households were advised to mop their rooms, and wash their hands with soap and water after cleaning, and to bury dead insects and water used to mop the floor.	No outstanding issues	This message was repeatedly stressed in radio discussions and jingles played throughout the 2019 campaign.
2d. Instruct homeowners to wash itchy skin and go to health clinic if symptoms do not subside.	All homeowners were instructed to wash with plenty of water and soap if any household member experienced itchy skin, and report to the nearest clinic if itching persisted.	No outstanding issues	VL Ghana supplied an antidote (Atropines) to all the health facilities except those in WMD, EMD, and MMD, where SumiShield 50WG was used, MSDS was shared with the clinics in the SumiShield districts.
3a. Indoor spraying only.	The SOPs were trained to spray indoors and only eligible surfaces of sleeping rooms. These include behind the doors, inner walls, thatch, ceiling, and eaves (where applicable) of all sleeping rooms.	No outstanding issues	Spraying of recommended indoor surfaces only was stressed in all trainings. VL Ghana also sent out job aids at least three times a week to all SOPs and Supervisors on recommended spraying of surfaces.

Mitigation Measure	Status of Mitigation Measures	Outstanding issues relating to required conditions	Remarks
3b. Training on proper spray technique.	VL Ghana continued to use a white cloth as an unmarked background wall for practical spray exercises for trainees to master the spray technique. During the TOT and SOP trainings, the project created obstacles for SOPs to maneuver around in spraying the rooms and still maintain perfection. Field simulation or "Live Fire" is a practical section in which SOPs practice the spray technique in a "real" structure that is identical in all features to the structures that will be sprayed during the spray campaign.	No outstanding issues	Trainers and supervisors emphasized the importance of keeping the nozzle tip at 45cm from the sprayable surface; spraying at the correct speed of 5 seconds for 2 meters of wall; and 5cm overlap of a swath.
3c. Maintenance of pumps.	At both TOT and SOP trainings, Supervisors, Site Managers, and TLs were trained in pump maintenance. Spray pumps were checked daily before use. Parts of spray pumps that were found to be faulty were replaced. Weekly lubrication and calibration of the spray pumps were carried out throughout the spray campaign.	No outstanding issues	Site Managers and supervisors serviced and calibrated all pumps weekly. Each operations site was supplied maintenance kits and had at least three spare pumps as a buffer.
4a. Choose sites for disposal of liquid wastes, including mobile soak pit sites, according to PMI BMPs.	The ECO visited and inspected all 24 operations sites to ensure that they had met PMI BMP standards before certifying the sites for use. The ECO also inspected all 10 MSPs site locations prior to their installations.		A team of inspectors including the ECO, EPA representatives, and DEHOs participated in the certification of all sites.
4b. Construct fixed and mobile soak pits with charcoal to adsorb pesticide from rinse water.	The project maintained 17 MSPs during the campaign including 2 big MSP IIs, introduced in 2019 and capable of serving 3 teams. These MSPs complemented Kumbungu and Bunkpurugu sites' fixed soak pits which had more than 25 SOPs. All MSPs were stacked with GAC to absorb pesticide from the end-of-day clean-up. All fixed soak pits were constructed with five layers of sawdust, charcoal, bigger stones, smaller stones, and gravel as the top layer in the appropriate dimensions of 2 × 1 × 1 meters. All construction was supervised by the ECO and EPA.	No outstanding issues	All the fixed soak pits (except Kpasenkpe, which will be converted in 2020) were converted into the improved soak pits with a metal cover and pipe lines connected to the bio-bed that have even distribution of affluent waste.
4c. Maintain soak pits as necessary during season.	All soak pits were rehabilitated and properly maintained before and throughout the spray campaign. The Nabuli soak pit developed minor cracks during the campaign but the problem was fixed by the ECO and DOC.	No outstanding issues.	All the fixed soak pits that were rehabilitated in 2017 was due for de-silting and refilling of the bio-beds.
4d. Inspection and certification of solid waste disposal sites before spray campaign.	Site inspection visits at the waste management companies will take place in June 2019 to ascertain their status and readiness before making final selection of a service provider for 2019 solid waste disposal. The companies are Cyclus Elmina Plastic Recycling Ltd, Zoil Services Ltd, and Fine Print Ltd	No outstanding issues	VL Ghana will ensure that the recycling companies have the capacity to recycle and incinerate all 2019 solid wastes.

Mitigation Measure	Status of Mitigation Measures	Outstanding issues relating to required conditions	Remarks
4e. Monitoring waste storage and management during campaign.	All store assistants clearly labeled sacks/boxes for collecting used nose masks, hand gloves, and all other waste. Contaminated materials were bagged separately from non-contaminated items, in accordance with BMP standards. The team stored and managed all solid waste generated during the spray campaign.		VL Ghana signed a Memorandum of Understanding (MOU) with two waste management companies to recycle the solid waste. All triple-rinsed empty bottles and empty sachets were stored at Langbinsi and Kumbungu when the central warehouse in Tamale was under rehabilitation. In August 2019, the project will move the waste to the identified certified waste management companies for final disposal.
4f. Monitoring disposal procedures post-campaign.	The ECO and EPA representative will supervise and monitor the post-spray campaign solid waste disposal procedure. Waste disposal most likely will be done at Cyclus and Zoil Services Ltd.	This is anticipated to be done in late August.	The project signed an MOU with these companies
5a. Maintain records of all pesticide receipts, issuance, and return of empty sachets/bottles.	All logistics assistants and store assistants kept records of all insecticide receipts, issuance, and returned empties on stock cards with a back-up in a ledger book at the regional, district, and operations site stores.	No outstanding issues	All ledger and stock cards were always updated and verified by the ECO and other regional supervisors during monitoring and supervision.
5b. Reconciliation of number of houses sprayed vs. number of sachets/bottles used.	The average number of structures sprayed per bottle/sachet was 4.47. This was calculated every day throughout the spray campaign to ensure that insecticide use was consistent with number of structures sprayed.	No outstanding issues	The number of structures sprayed per bottles/sachets used was tracked using the Performance Tracking Sheet and the database on daily basis.
5c. Visual examination of houses sprayed to confirm pesticide application.	The regional team, district M&E team, TLs, and FSs performed regular spot checks in sprayed houses to verify and confirm insecticide application. This was mainly done through visual examination of sprayed walls, eaves, and ceilings.	Unlike Actellic where evidence of spraying on wall is visible, SS does not leave residue on the wall. It was somewhat visible on painted walls, very faint traces can be seen on mud surfaces and, almost nothing on cement walls.	All supervisors were key in checking the quality of spray by DOS of the SOPs. It was also observed that whenever pressure was introduced in the process of mixing SS and the foam, if not allowed to settle, it is likely to leave traces on the wall.
5d. Perform physical inventory counts during the spray season.	ECO and other supervisors conducted regular physical counts of randomly selected inventory items by using the storekeeper performance checklist to verify the stocks. In all, 107 store inspections were carried out during the campaign and 43 “red flags” were raised in 2019.	No outstanding issues	All items stored had stock cards. ECO and other regional supervisors checked and verified the stock cards and used the data for final inventory reconciliation.