



U.S. PRESIDENT'S MALARIA INITIATIVE



GHANA END OF SPRAY REPORT

SPRAY CAMPAIGN: MARCH 24–APRIL 28, 2020

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ACRONYMS

BMP	Best Management Practices
BND	Bunkpurugu-Nakpanduri District
CHN	Community Health Nurse
COVID-19	Coronavirus Disease 2019
DEA	Data Entry Assistant
DEHO	District Environmental Health Officer
DHIS2	District Health Information Software 2
DHPO	District Health Promotion Officer
DOS	Directly Observed Spraying
ECO	Environmental Compliance Officer
EMD	East Mamprusi District
EPA	Environmental Protection Agency
GHS	Ghana Health Service
GUD	Gushegu District
IEC	Information, Education and Communication
IRS	Indoor Residual Spraying
ITN	Insecticide-Treated Net
KAD	Karaga District
KUD	Kumbungu District
M&E	Monitoring and Evaluation
MaVCOC	Malaria Vector Control Oversight Committee
MMD	Mamprugu Moaduri District
NMCP	National Malaria Control Program
ODK	Open Data Kit

SBCC	Social and Behavior Change Communication
SEA	Supplemental Environmental Assessment
SOP	Spray Operator
TL	Team Leader
TOT	Training of Trainers
TSD	Tatale-Sanguli District
USAID	United States Agency for International Development
WMD	West Mamprusi District
YND	Yunyoo-Nasuan District

EXECUTIVE SUMMARY

In 2020, the U.S. President’s Malaria Initiative (PMI) VectorLink Project in Ghana implemented a 30-operational day indoor residual spray (IRS) campaign in nine districts in northern Ghana: Bunkpurugu-Nakpanduri (BND), East Mamprusi (EMD), Gushegu (GUD) Karaga (KAD), Kumbungu (KUD), Mamprugu Moaduri (MMD), West Mamprusi (WMD), Tatale-Sanguli (TSD), and Yunyoo-Nasuan (YND). The campaign, which included TSD for the first time, took place from March 24 to April 28, 2020. In five districts—BND, EMD, KUD, MMD (Yizesi sub-district), and YND—VectorLink Ghana sprayed eligible animal shelters in addition to sleeping/living structures, to gather more evidence on how malaria vectors use animal shelters as a resting place. With arrival in Ghana of the 2019 novel coronavirus disease (COVID-19) in mid-March 2020, the project had to quickly assess and adjust IRS implementation protocols, put in place contagion-mitigating measures, and relay important COVID-19 and malaria messaging. Among the 2,580 seasonal employees, there were no known confirmed cases and no reported cases of suspected symptoms of COVID-19, and the campaign finished successfully. Table ES-1 presents summary results of the 2020 spray campaign.

TABLE ES-1. 2020 VECTORLINK GHANA IRS SUMMARY

Number of districts covered by IRS in 2020	9 districts: BND, EMD, GUD, KAD, KUD, MMD, TSD, WMD, and YND
Insecticide used in 2020 IRS	Organophosphate (Actellic® 300CS, 1 district) neonicotinoid combined with pyrethroid (Fludora® Fusion, 4 districts) and neonicotinoid (SumiShield® 50WG, 4 districts)
Structures targeted for spray in 2020 (found by spray operators in 2019 plus estimate for TSD)	346,285
Structures found by spray operators in 2020	366,283
Structures sprayed in 2020	339,139
Spray coverage	92.6%
Animal shelters found	6,222
Animal shelters sprayed	6,219
Population protected	965,467 (including 21,295 pregnant women and 161,750 children under 5 years)
Dates of IRS campaign	March 24–April 28
Length of IRS campaign	30 operational days
Number of people trained with funds from the US Government to deliver IRS in 2020*	843 (603 men, 240 women)

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

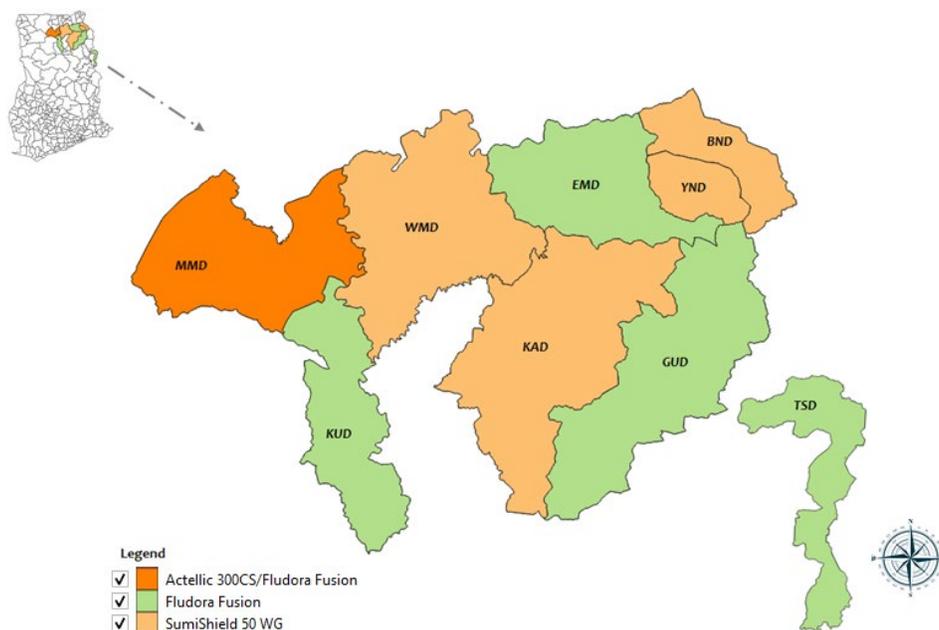
IRS coverage in 2020 exceeded the PMI contractual coverage target of 85% and the National Malaria Control Program coverage target of 90%. Spray quality results demonstrated 100% mosquito mortality across all districts for the three insecticides used: pirimiphos-methyl (Actellic® 300CS), clothianidin (SumiShield® 50WG), and a combination of clothianidin and deltamethrin (Fludora® Fusion). Building on lessons learned from previous campaigns, the project continued resolving challenges of delayed household preparation, refusals, and locked structures. This year VectorLink Ghana engaged more community health nurses and government officers than in 2019 to mobilize for increased IRS acceptance and ownership by the population.

I. COUNTRY BACKGROUND

Since 2006, the U.S. President’s Malaria Initiative (PMI) has protected millions of people in Africa from malaria through indoor residual spraying (IRS), which kills the mosquitoes that transmit malaria by spraying insecticide on the walls, ceilings, and other indoor surfaces where those mosquitoes rest. In September 2017, the United States continued its commitment to tackle this deadly disease, launching the five-year PMI VectorLink Project. Working across 24 countries in sub-Saharan Africa as well as in Cambodia and Latin America, PMI VectorLink equips countries to plan and implement integrated vector control, including safe and cost-effective IRS programs, conducts entomological monitoring activities, and provides support for the deployment of insecticide-treated nets (ITNs).

IRS is a major part of Ghana’s national malaria control strategy. The country’s National Strategic Plan for Malaria Control (2014–2020) seeks to protect at least 80% of the population at risk of contracting malaria by 2021 using universal coverage of ITNs, IRS in areas of high parasite prevalence, seasonal malaria chemoprevention in eligible districts of the North, larviciding in targeted areas, and prevention of malaria in pregnancy. The National Malaria Control Program (NMCP) recently completed the design of a new strategy for the next five years, 2021–2025. Since 2008, PMI has supported the NMCP in reducing the burden of malaria by funding IRS in northern Ghana. The VectorLink Ghana project currently implements IRS in nine districts in two regions following the creation of six new regions in Ghana in 2019: five districts in the North East Region (Bunkpurugu-Nakpanduri (BND), East Mamprusi (EMD), Mamprugu Moaduri (MMD), West Mamprusi (WMD), and Yunyoo-Nasuan (YND)); and four districts in the Northern Region (Gushegu (GUD), Karaga (KAD), and Kumbungu (KUD), and Tatala-Sanguli (TSD)). PMI VectorLink also included spraying animal shelters due to a study on *Anopheles* resting and biting behavior which implicated outdoor resting. Specifically, the study found animal shelters became preferred resting locations and animals became the biting preference when vectors were pushed out of sprayed human dwellings. To further investigate those findings on a large scale, the project sprayed eligible animal shelters in five districts.

FIGURE 1. MAP OF 2020 PMI IRS DISTRICTS



I.1 2020 IRS AND RELATED OBJECTIVES

In the 2020 IRS campaign, VectorLink Ghana worked in partnership with the Ghana Health Service (GHS), District Assemblies, and the NMCP to conduct IRS operations. The target for the nine districts was to spray 346,285 structures and protect over 900,000 people.¹ The project's primary objective was to reach a minimum coverage of 85% of the structures found in each district by implementing high-quality IRS operations (and by spraying at least 90% of eligible structures per NMCP coverage target). In addition, the project carried out the following IRS-related activities:

- Spraying of animal shelters in BND, EMD, KUD, MMD (Yizesi sub-district), and YMD.
- Introduction of mobile spray data collection in two operations sites in two districts (GUD and TSD).
- Assessment of IRS self-mobilization, initially planned in the new district, TSD, conducted in select communities by encouraging community leadership to assume full responsibility for IRS mobilization with no payment of stipend to mobilizers.
- Roll-out of VectorLink Collect in Ghana to manage IRS data.
- Preparation of a new nationwide supplemental environmental assessment (SEA) for 2020–2025 because the current one expired in March 2020.
- Technical support for strategic decision making and deployment of interventions for malaria control to the Malaria Vector Control Oversight Committee (MaVCOC).
- Capacity building at all levels of the GHS on vector control to ensure proper monitoring, implementation, and sustainability of IRS.

I.2 2020 KEY ACHIEVEMENTS

VectorLink Ghana achieved the following specific results:

- Launched spray campaign as scheduled on March 24, one week earlier than in 2019, to avoid significant overlap with seasonal rains.
- Sprayed three insecticides, Actellic® 300CS, Fludora® Fusion, and SumiShield®50 WG, in a single spray campaign.
- Expanded to a new district, TSD.
- Reached an overall spray coverage of 92.6%, which exceeds PMI and NMCP coverage targets. This year's coverage was slightly lower than 2019's spray coverage rate of 94.3%.
- Protected a total population of 965,467, including the most vulnerable groups of 161,750 children under 5 years and 21,295 pregnant women.
- Conducted spray quality test results, which showed 100% mortality for all three insecticides for all test mosquito populations, indicative of high spray quality.
- Successfully integrated spraying of animal shelters into the IRS campaign in five districts.
- Increased female participation in all staff categories by 17.5%. In 2020, out of all the seasonal workers hired, VectorLink Ghana hired 551 females as compared with 469 in 2019.

During the campaign, NMCP representatives proactively supported the project in IRS supervision, mobilization, and education of beneficiaries and district partners on 2019 novel coronavirus disease (COVID-19), how to protect oneself from the disease, and the importance of conducting World Health Organization (WHO)-designated essential malaria control activities such as IRS and mass ITN distribution.² Due to the COVID-19 pandemic, scheduled short-term technical assistance trips and residual efficacy monitoring were suspended.

¹ The target comprises the total structures found in 2019 plus an estimated 30,000 structures for the new district. The population target is based on 913,781 people found in 2019 in the districts the project sprayed plus an estimated 76,798 people for the new district.

² Tailoring Malaria Intervention in the COVID-19 Response, WHO, April 9, 2020.

2. IMPLEMENTATION OF IRS ACTIVITIES

2.1 IRS PLANNING AND PARTNER COLLABORATION

To effectively implement a successful IRS operation and improve stakeholder participation as well as sustainability of the IRS program, VectorLink Ghana conducted microplanning meetings with stakeholders at the community, district, and regional levels prior to the spray campaign. Representatives from the GHS Regional and District Health Directorates and District Assemblies as well as some paramount community chiefs attended the meetings. The meetings strengthened project relations with these stakeholders, increased local participation in the IRS campaign, and raised operational issues for consideration. The main topics for planning and collaboration were the following:

- Recruitment of spray operators (SOPs) and team leaders (TLs).
- GHS support to conduct medical exams for SOPs and TLs.
- Social and behavior change communication (SBCC) plans and strategies.
- Insecticide rotation plan, reasons for rotation, and dealing with misconceptions about IRS including messages on different insecticides.
- Collaboration with selected community chiefs to take charge of their community mobilization for spraying.
- Collaboration on the use of government-assisted facilities as operations site storage and offices.

2.2 TRAINING

IRS is highly technical and requires rigorous and comprehensive training of personnel to ensure correct application of insecticide on walls. In order to achieve the intended sustained impact and solid knowledge to carry out other components of IRS, IRS trainings cover supervision, logistics, monitoring and evaluation (M&E), and SBCC. VectorLink Ghana trained seasonal staff prior to the implementation of the spray campaign in a series of eight trainings to prepare specific skills for each component of IRS.

VectorLink Ghana included field simulation sessions in the Training of Trainers (TOT), SOP, and TL training. The purpose of these sessions was to expose spray teams as closely as possible to real-life situations they were likely to encounter during the spray campaign. During these sessions, trainees visited nearby compounds to practice spray techniques, data collection, household preparation, and the delivery of IRS key messages. As shown in Table 1, the project trained a total of 2,716 people (2,193 males, 523 females).

By the time Ghana confirmed its first COVID-19 case and PMI VectorLink had issued its mitigation guidelines, VectorLink Ghana had completed all the trainings except for the spray operator training which was mostly conducted outdoors due to the practical sessions. The project implemented social distancing on the last day of the training by moving the closing sessions outdoor.

TABLE 1. PEOPLE TRAINED, 2020

Categories of Persons Trained	Training on IRS Delivery										Other Trainings				TOTAL		
	Training of Trainers: Spray Ops		Spray Operations		M&E and Data Entry		Logistics and Store Management		Training of Trainers		IEC Mobilization		Finance				
	M	F	M	F	M	F	M	F	M	F	M	F	M	F	M	F	TOTAL
Disease Control Officers	9	0													9	0	9
District Environmental Health Officers	9	0													9	0	9
Environmental Protection Agency	0	1													0	1	1
National Malaria Control Program	0	1													1	0	1
District Information Officers					9	0									9	0	9
Health Promotion Officers									9	0					9	0	9
District Supply Officers							6	0							6	0	6
Spray Operators			458	196											458	196	654
Team Leaders			91	36											91	36	127
Data Assistants					30	15									30	15	45
M&E Assistants					16	1									16	1	17
Logistics Assistants							7	1							7	1	8
Store Assistants							8	20							8	20	28
IEC Assistants									22	5					22	5	27
IEC Mobilizers (IRS)											1,213	128			1,213	128	1,341
IEC Mobilizers (TSD enumeration)											159	7			159	7	166
Field Supervisors	54	8													54	8	62
Site Managers	19	12													19	12	31
Finance Assistants													4	4	4	4	8
Community Health Nurses									69	89					69	89	158
TOTAL M/F	91	22	549	232	55	16	21	21	100	94	1,372	135	4	4	2,193	523	2,716
TOTAL	113		781		71		42		194		1,507		8		2,716		

Note: IEC=information, education and communication

2.3 SPRAY OPERATIONS AND SUPERVISION

The 2020 spray campaign took place over 30 operational days between March 24 and April 28. Ghana continued the strategy of spraying simultaneously peri-urban and hard-to-reach communities at the onset of the campaign to ensure there was adequate time to deal with the challenging peri-urban communities and finish IRS in the remote areas before the rains washed away the roads. As part of the morning mobilization activities, site managers and field supervisors held morning assemblies where they addressed SOPs and TLs on field findings and expectations for the day. TLs filled out health-check forms for each SOP. After the SOPs retrieved the leftover insecticides from the designated soak pit barrels, they departed to the communities for the spray work. Site managers assigned spray teams to communities and allocated vehicles for transport.

On a typical spray day, field supervisors and TLs supervised the distribution of SOPs to compounds designated for spraying. TLs conducted Directly Observed Spraying (DOS) while field supervisors observed homeowner preparation and SOP performance. SOPs recorded spray data using the Daily Spray Operator form. At the end of each day's activities, all field supervisors and site managers supervised end-of-day clean-up procedures. Field supervisors and TLs observed end-of-day procedures at operation sites with mobile soak pit. TLs also summarized all SOP data on the Team Leader Summary forms and submitted them to their field supervisor who further verified the data and submitted the forms to the site managers. Site managers summarized the data to complete the Spray Performance Tracking Sheet, which was posted on the walls at 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 data entry.

The rain interrupted spraying for one day. Teams in two operations sites (Yunyoo, YND, and Kumbungu, KUD) did not depart for the field; teams at all other sites went to the field later than usual, after the rain stopped in their areas. Since GUD holds a major market, the district IRS team adjusted the spray around market days.

From the start, VectorLink Ghana put in place strict personal protection measures to mitigate COVID-19 potential impact. They included (i) mandatory face masks wearing by all at the sites, in the field and while in vehicles; (ii) All SOPs wore latex gloves while recording spray data and during household preparation to avoid touching items with bare hands; (iii) Social distancing was exercised at breakfast, morning mobilization, during spraying and at the end of day cleanup; (iv) at each site, the project set up multiple handwashing stations and displayed COVID 19 information posters; and (v) VectorLink Ghana sent regular messages to all seasonal workers through SMS and re-emphasized safety during morning assemblies at all sites.

2.4 RECRUITMENT

In 2020, VectorLink Ghana engaged a total of 2,636 as seasonal staff, 20.9% of whom were females (a 17.5% increase from 2019).³ Table 2 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, VectorLink Ghana employed 2,480 seasonal workers.⁴

³ In 2019 and 2020, VectorLink Ghana had 469 and 551 females respectively

⁴ Packers are not considered seasonal workers since they are not trained in any IRS activity.

TABLE 2. PEOPLE HIRED, 2020

Category	BND		EMD		GUD		KAD		KD		MMD		TSD		WMD		YND		TML		All		% Female	
	M	F	M	F	M	F	M	F	M	F	M	F	M	F	M	F	M	F	M	F	M	F		Total
Data Entry Assistant	4	3	5	2	4	0	3	1	0	4	2	0	2	0	1	6	0	0	0	0	21	16	37	43.2%
Finance Assistant	1	0	1	0	0	1	0	1	0	1	1	0	1	0	0	1	0	0	0	0	4	4	8	50.0%
IEC Assistant	3	0	3	2	3	0	3	0	2	0	1	1	2	1	3	1	2	0	0	0	22	5	27	18.5%
Logistics Assistant	1	0	1	0	1	0	1	0	0	1	1	0	1	0	1	0	1	0	0	0	8	1	9	11.1%
Store Assistant	2	1	1	4	1	3	1	2	0	2	0	2	0	2	2	2	0	2	1	0	8	20	28	71.4%
Mobilizer	161	7	184	28	207	19	160	21	140	7	44	5	160	7	106	41	70	4	0	0	1,232	139	1,371	10.1%
Security Guard	6	0	11	0	8	0	7	0	4	0	5	0	3	1	6	0	4	0	0	0	54	1	55	1.8%
Site Manager	3	0	3	2	3	1	1	2	0	2	1	1	1	1	2	1	1	1	0	0	15	11	26	42.3%
Spray Operator	47	28	97	43	59	26	46	11	43	19	35	6	36	19	58	43	22	5	0	0	443	200	643	31.1%
Supervisor	5	0	9	1	5	1	5	0	4	0	3	1	3	1	7	3	2	0	0	0	43	7	50	14.0%
Team Leader	11	3	21	7	12	5	10	2	9	4	7	1	7	4	12	9	4	2	0	0	93	37	130	28.5%
Washer	0	8	0	15	0	9	0	7	0	5	0	4	0	5	1	9	0	4	0	0	1	66	67	98.5%
Water Fetcher	2	1	0	0	4	0	0	0	0	0	2	0	0	2	0	4	2	0	0	0	10	7	17	41.2%
M&E Assistant	1	0	2	0	2	0	1	0	1	0	1	0	1	0	2	0	1	0	0	0	12	0	12	0.0%
Packer	17	5	18	12	14	7	14	1	23	1	17	5	6	0	10	6	0	0	0	0	119	37	156	23.7%
Total M/F	264	56	356	116	323	72	252	48	226	46	120	26	223	43	211	126	109	18	1	0	2,085	551	2,636	20.9%
Grand total	320		472		395		300		272		146		266		337		127		1		2,636			

2.4.1 OPERATIONS SITES

During the campaign, VectorLink Ghana worked out of 26 operations sites with fixed soak pits and eight operations sites with mobile soak pits for a total of 34 sites. Due to close collaboration with the District Assemblies, the GHS, and community chiefs and other private entities, the project received generous in-kind support for its operations facilities. Of 26 sites with a fixed soak pit, District Assemblies donated their entire offices location for 20 sites, GHS donated two sites, chiefs donated two sites, and the project rented space for two sites. Local communities provided temporary (1-2 weeks) space for the eight operation sites with a mobile soak pit; the space served as an office and storeroom. Space at some temporary sites was only enough to store personal protective equipment and spray equipment. District logistic assistants re-supplied the stores with insecticide every day or every other day. The project used 32 warehouses, 26 of them located at operations sites with a fixed soak pit. The other six warehouses were strategically located as follows: Tamale (central insecticide store), Walewale (WMD insecticide store), Langbensi (EMD insecticide store), Kunkwa (mobile soak pit site store, MMD), Nasia (mobile soak pit site store, WMD), and Gumani (central IRS supply store). District Assemblies donated 21 warehouses (20 at operations sites with a fixed soak pit and at the WMD insecticide store), the GHS donated three warehouses (Nagboo site, EMD, Kpatinga, GUD, and the Regional Medical Store in Tamale), community chiefs supported four (Kunkwa, mobile soak pit site store (MMD), Nasia, mobile soak pit site store (WMD), Nasuan fixed soak pit site store (YND), and Sandua fixed soak pit site (KAD)), and the Presbyterian Church supported one insecticide store in Langbensi (EMD). The project rented three warehouses (in Dalun and Kumbungu, both operations sites with fixed soak pits in KUD, and a store for IRS supplies in Gumani, Tamale).

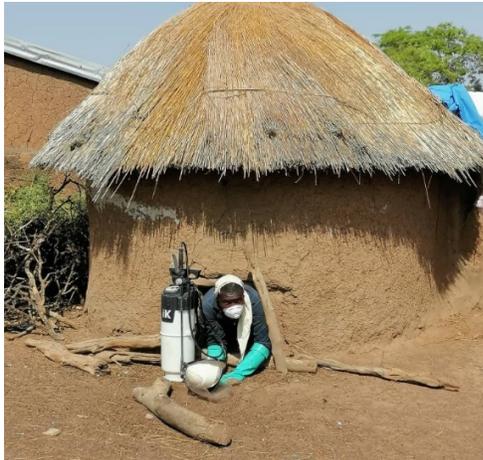
2.4.2 OTHER OPERATIONAL DETAILS

Nozzle calibration: The spray pump nozzle determines the amount of insecticide discharged on the spray surface. Field supervisors and site managers conducted nozzle calibration and replacement in all sites once a week throughout the campaign. In 2020, the project issued 1,113 nozzles and used 722. Of the 722 nozzles used, 78 were replacements of an original nozzle, due to out-of-range discharge.

Mobile payment: VectorLink Ghana continued using a mobile money payment system to pay all seasonal workers. This significantly reduced payment delays and eliminated risks associated with managing large amounts of cash in the field.

Expansion to TSD: In late 2019, VectorLink Ghana and the GHS conducted analysis of potential IRS expansion districts in the two intervention regions and, in consultations with PMI and the NMCP, selected TSD for expansion in 2020. Initially, the project estimated 30,000 eligible structures as an IRS target for the new district based on data provided by the TDS District Assembly. This early estimation was done to meet deadlines for ordering insecticide, which requires about a seven-month lead time, and for ordering other internationally purchased IRS supplies. About two months before the spray campaign began, the project completed a compound enumeration and marking exercise and used an estimate of four eligible structures per compound. The enumeration exercise revised the pre-determined spray target of 30,000 to 28,000 eligible structures in TSD. VectorLink Ghana collaborated with the District Assembly to secure two operations sites with storage spaces. The project completed renovations and soak pit construction in the two sites, established close and productive relations with stakeholders, and successfully executed recruitment and training of seasonal personal. These efforts led to a high-acceptance campaign with IRS coverage of 95.2% in TSD.

Spraying animal shelters: In response to PMI's request to target vectors resting in animal shelters based on *Anopheles* resting behaviors, the project carried out spraying of these shelters in BND, EMD, KUD, MMD (Yizesi sub-district), and YMD. To estimate the number of eligible shelters, in November 2019, VectorLink Ghana conducted a rapid survey using size, material, and easy access as variables. From 500 compounds surveyed across nine districts, the project estimated that 32,000 shelters in five districts would be eligible and feasible to spray. By the end of the campaign, however, SOPs reported having sprayed only 6,219 shelters. The main reasons for the difference were: SOPs found that many animal shelters were shared with poultry, entrances were too small for SOPs to enter. In many areas, it is not customary to have animal shelters as part of a



Spray operator exiting animal shelter, East Mamprusi District

household but rather to let the animals roam freely across and around the compounds. Nevertheless, where spraying of animal shelters proved feasible, beneficiaries were very welcoming to the spraying.

2.4.3 IRS SUPERVISION

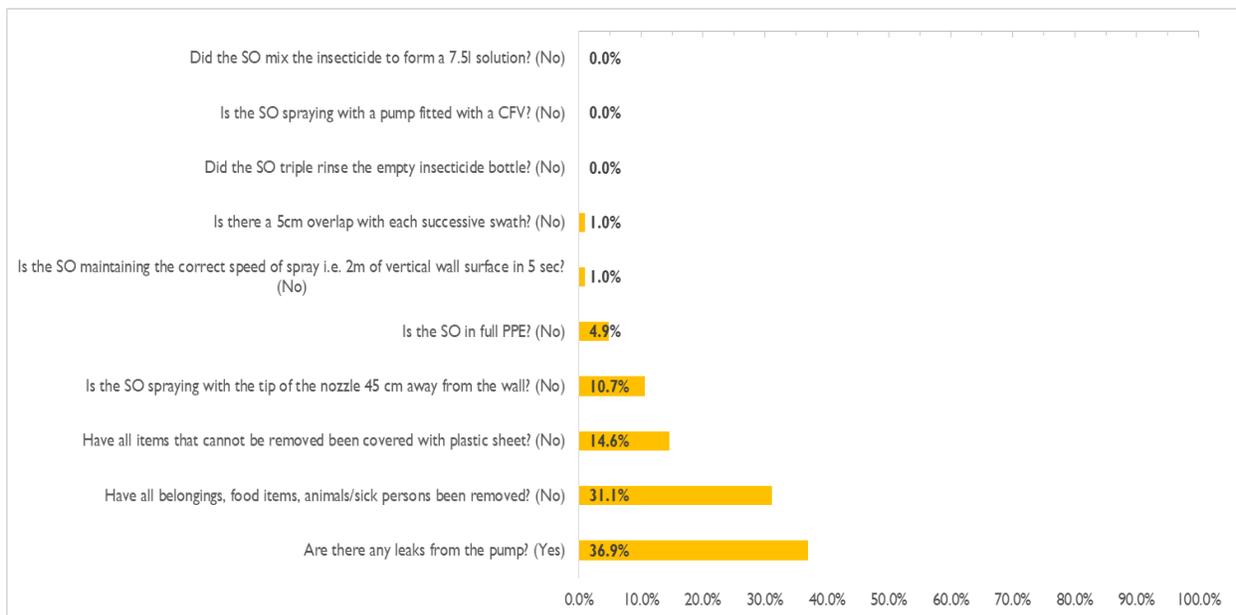
VectorLink Ghana maintained thorough monitoring and supervision at all IRS levels—regional, district, and operations sites—in accordance with the project’s supervisory plan. The VectorLink Ghana technical team supervised at the regional level by providing overall operational and managerial support, and oversight of all districts. The district-level monitoring team included VectorLink district operations coordinators, M&E assistants, and district logistics assistants. District health officers from various departments actively participated in supervision at the district-level. At the operations site level, site managers, field supervisors, and TLs provided guidance and oversight. All

supervisors used smartphone-based checklists to conduct inspections of SOP morning mobilization and SOP vehicles; homeowner preparation and SOP performance; storekeeper performance; and end-of-day clean-up.

In the field, field supervisors and TLs with the assistance of community mobilizers supervised the distribution of SOPs to compounds designated for spraying that day. TLs conducted only DOS inspections while field supervisors also supervised homeowner preparation and SOP performance. In total, VectorLink Ghana completed 16,288 DOS inspections. Of these, only 103 (0.6%) raised red flags (Figure 1); most of these were addressed on the spot. Analysis of the DOS inspections showed that the largest percentage of red flags (36.9%) was related to spray pumps that had insecticide dripping from their nozzle tips. Other red flags were attributed to household belongings that SOPs did not remove before spraying (31.1%), improper use of plastic sheets (14.6%), and inaccurate spray distance to the wall (10.7%).

All field supervisors, government partners and project staff working in the field monitored compliance with COVID-19 mitigation guidelines by the seasonal spray personnel and beneficiaries.

FIGURE 2. DISTRIBUTION OF DOS RED FLAGS BY QUESTIONS ASKED (N= 103)



Note: CFV=control flow valve, SO=spray operator

2.5 INSECTICIDE MANAGEMENT

Insecticide choice was based on the results of insecticide susceptibility and residual efficacy tests conducted in 2019 and the desire to implement an insecticide rotation strategy. Vectors from all sites were susceptible to clothianidin, the active ingredient of SumiShield® 50WG and Fludora® Fusion. Resistance (in EMD) and possible resistance (in Tamale metropolis area, non-IRS district) was detected to pirimiphos-methyl, the active ingredient in Actellic® 300CS. The data emphasized the importance of rotating among different classes of IRS insecticide to prevent further development of resistance to pirimiphos-methyl. VectorLink Ghana presented findings to MaVCOC and the members agreed to switch from Actellic® 300CS to SumiShield® 50WG in BND, KAD, and YND and to Fludora® Fusion in EMD, GUD, KUD, and TSD. Use of Actellic® 300CS would be restricted to MMD, where vectors had showed continued susceptibility to pirimiphos-methyl.

Table 3 shows insecticide needs, procurements, and use for the 2020 campaign. VectorLink Ghana needed 76,952 units of insecticide to spray the targeted 346,285 structures using a ratio of 4.5 structures per unit of insecticide. After the 2019 campaign, 4,148 bottles of Actellic® 300CS and 5,687 sachets of SumiShield® 50WG were left over; this leftover Actellic® 300CS was enough to spray MMD. The project procured 41,730 sachets of Fludora® Fusion and 25,440 sachets of SumiShield® 50WG. The total available insecticide for the 2020 IRS campaign was 77,005 units. The project received UNITAID co-payment through the Next Generation IRS project to procure the insecticide.

Of 77,005 units of insecticide distributed to the nine districts, 76,498 units were consumed during the campaign and six units were lost due to reported incidents of insecticide misappropriation (see Section 4.2). The closing stock after the campaign was 481 sachets of Fludora® Fusion (batches FLSA190090 and FLSA190093) that expires in December 2021 and 20 sachets of SumiShield® 50WG (batches 199879F0 and 199880F0) that expires in June 2022, for a total of 501 sachets.

TABLE 3. 2020 IRS INSECTICIDE USAGE SUMMARY (UNITS)

2019 balance brought forward	9,835
Total procured and received	67,170
Total in stock before campaign	77,005
Total usage during the campaign	76,498
Insecticide lost through misappropriation	6
2020 stock in hand	501

VectorLink Ghana rolled out the use of serial numbers for each insecticide unit. Store assistants serialized all insecticide bottles and sachets with pre-ordered barcoded stickers. They also used insecticide tracking sheets and a mobile application on a tablet to track the insecticides that TLs received and returned daily at each operations site. Also, VectorLink Ghana added a column to the Daily Spray Operator form to record the insecticide serial number against the structure at which each insecticide unit was mixed to strengthen insecticide stock management and reduce the risk of pilferage. Annex A shows the post-spray balance of insecticide and main materials and supplies procured for the 2020 campaign.

2.6 COMMUNICATION ACTIVITIES

Communication activities commenced simultaneously in February in all IRS districts, following the drawing up of Community Communication Work Plans by IEC assistants and district health promotion officers (DHPOs) in January. These plans, deduced from the overall IEC Work Plan, provided detailed timelines of activities to be conducted at the community level. IEC assistants coordinated all outreach activities at each operations site. Overall, the focus was on household engagement in preparation for spraying, changing of negative attitudes

toward IRS, and strengthening the role of community leadership and community-level GHS staff in IRS mobilization.

Integration of IRS into routine health promotion: Last year, VectorLink Ghana began integrating IRS into routine GHS health promotion activities at the community level by engaging 46 community health nurses (CHNs) in spray mobilization work. In 2020, the project expanded the pool of trained CHNs to 177; 154 of them came back to work during the spray visit itself to help improve IRS acceptance in their GHS-assigned communities. After the campaign, the CHNs will continue to assist with providing feedback to communities on IRS, and they will continue including IRS messaging in their routine health promotion activities at the community and the facility levels.

Community participation and education: The project continued its focus of improving the participation of communities in IRS. Community meetings started in February and the majority had been completed by March 12, when the first COVID-19 case was reported in Ghana. This required the project to adjust meeting formats. In TSD, the new IRS district, residents received education on IRS that emphasized household preparation, after-spray clean-up, and maintenance of sprayed surfaces. In total, the project held 1,528 meetings with 48,969 attendees.

VectorLink Ghana together with the GHS conducted IRS outreach during health programs such as immunization campaigns and Child Welfare Clinics, visited schools, mosques, and churches, and held meetings of community-based groups and associations. A total of 1,106 of these activities were conducted before schools were closed and mosques and churches were asked to stop in-person services due to COVID-19.

This year, the project ensured that IRS beneficiaries were fully aware of the COVID-19 pandemic and appropriate measures to avoid getting sick e.g. stay home, use face mask when in public, social distance as much as possible when in public, avoid handshakes, washing hands frequently, etc.. The project further incorporated messages on symptoms (dry cough, sore throat, fever, difficulty in breathing, etc.) and the need for self-isolation should anyone experience any of the symptoms which manifest within two weeks. IEC assistants included demonstrations on coughing into a bended arm as a means of protecting others and participants were encouraged to call the national phone numbers when they suspected that they may have the disease. COVID messages were included in radio discussions with GHS panelists



Community members in Tatala-Sanguli District after receiving education on IRS for the first time. Photo was taken in February 2020 before the first reported case of COVID-19 in Ghana.

Mobilization: Over 1,300 community volunteers worked as IRS mobilizers. They were accompanied by representatives from community chiefs when mobilizing, sensitizing, and monitoring spraying in their communities. In TSD, the first-time IRS district, the project carried out the enumeration and sensitization exercise that reached 25,383 persons with IRS messages and recorded 7,155 households sensitized (Table 4).

TABLE 4. PRE-SPRAY HOUSEHOLD MOBILIZATION

	BND	EMD	GUD	KAD	KUD	MMD	TSD	WMD	YND	Grand Total
Households	306	668	221	242	486	157	7,155	362	24	9,621
Males*	496	974	364	480	644	285	11,212	564	44	15,063
Females*	581	1,017	402	499	674	323	14,171	669	55	18,391
Total people	1,077	1,991	766	979	1,318	608	25,383	1,233	99	33,454

* Reached with IRS messages

In accordance with the one-time enumeration system that VectorLink Ghana adopted, in 2020 only newly built compounds were enumerated in the previously sprayed districts. During the enumeration process, the new households were sensitized.

Also, in February 2020, the project carried out targeted sensitization of 2,954 households that had refused IRS or whose structures were found locked in 2019. In addition, the project worked closely with local authorities to sensitize 83 communities that have not achieved the NMCP spray coverage target of 90% since 2018. Post-spray data analysis showed that spray coverage increased in 43 of the communities with 21 achieving above the target.⁵

Community self-mobilization: VectorLink Ghana introduced IRS self-mobilization to assess the feasibility of the approach, which involves community leadership mobilizing their communities for spraying, under the guidance of the project. These communities were sprayed without any financial remuneration to the community leaders who led sensitization and mobilization. Although TSD was initially targeted for the assessment, the project decided to include districts that had received IRS in the past. Up to three communities in each of the 26 operational sites were selected. In the end, 73 out of 1,482 communities participated in the self-mobilization initiative with an average spray coverage of 96.7%. However, while this is higher than the overall average coverage for 2020, only 14 communities experienced an increase in coverage from 2019 and 17 achieved the same coverage. Since the remaining 42 communities performed lower than in 2019, the project will search for other approaches to contain the cost of mobilization without having an impact on IRS coverage.

Insecticide rotation messaging: VectorLink Ghana included specific messages clarifying benefits of the rotation in order to prolong the efficacy of existing insecticides and continue reducing malaria vector populations. It printed large-size photos of new insecticides packaging for the outreach events to ensure communities accepted the new insecticides and understood the importance of insecticide rotation, and to allay any fears residents had about the new products.

Mass media campaign: VectorLink Ghana ran a media campaign, which was critical to support for spray operations (Table 5). The media campaign started two weeks ahead of the IRS campaign. It helped to engage beneficiaries, and to reinforce and support interpersonal efforts at the community level. Seven radio stations addressed various aspects of IRS through radio discussions, social announcements, and radio spots. The project used pick-up trucks fitted with a public announcement system and megaphones to support the dissemination of IRS messages and spray dates. Mobilizers displayed posters describing pre and post-spray IRS steps and the Community Spray Calendar in public places. The project worked with community leaders to announce spray dates using a traditional

⁵ Out of 83, one community had 69.97% coverage. Twenty-two communities had coverage between 70 - 80% while eighteen communities had coverage between 80-85%. Forty-three communities reached 85% and higher with few small communities reached 100% coverage.

communication tool called “gong gong” and also worked with religious leaders to announce spray dates during their calls to

TABLE 5. MASS MEDIA CHANNELS USED TO SUPPORT SPRAY CAMPAIGN

Activity	Event Occurrence
Radio spots; jingles	988
Radio programs (interactive shows)	30
Radio announcements	728
IRS Homeowner Preparation posters distributed	4,446
IRS Community Spray Calendar posters distributed	4,446
Gong gong beating	1,370

Peace Corps volunteers: For the 2020 spray campaign, 12 Peace Corps volunteers from three districts offered to help prepare their communities. Six were trained and were asked to train their colleagues who could not attend the training. However, the volunteers were recalled to the United States before the campaign started, due to the COVID-19 pandemic.

World Malaria Day: While still in the midst of the spray campaign, the project commemorated World Malaria Day, which is observed on April 25, by organizing a radio discussion to create awareness of the various interventions and levels of uptake. The Malaria Focal Person for the Northern Region shared data on malaria indicators and the impact of the interventions on the disease. Panelists called community leadership to action by describing how they could help improve uptake of the interventions in their areas.

Monitoring communication activities: VectorLink Ghana and GHS officials monitored communication activities. VectorLink Ghana developed a mobile application called Pre-information Tracker with the ability to take GPS coordinates of each community. IEC assistants used this app to supervise how well communities had been informed about IRS prior to the arrival of the spray teams. At all 3,765 compounds visited, beneficiaries demonstrated awareness of the spray date, room preparation, after-spray clean-up, and steps for spray surface maintenance. In some instances, the GPS signal failed so that capturing the GPS location was impossible, and the IEC assistants had to revert to paper-based forms. The project will review the tool to improve its functionality and will use it in subsequent campaigns as it served a dual purpose of checking IEC assistants and mobilizers’ performance. Also, to effectively track the number of days worked by mobilizers, the project converted the one-page loose-leaf attendance sheet into a Mobilization Attendance booklet for efficient record keeping and verification.



From left Malaria Focal Person, Dr. Seidu; Former Gushegu District Director of Health, Abdul-Rahaman Yakubu, and VectorLink Ghana Environmental Compliance Officer, Abukari Yakubu

2.7 CAPACITY BUILDING

Between January and March 2020, VectorLink Ghana conducted trainings on IRS. In addition to seasonal workers, 47 representatives from the NMCP, Environmental Protection Agency (EPA), District Assemblies,

and GHS attended the sessions. Of them, 36 regional and district officers represented four GHS departments (health promotion, warehouse and logistics, disease control, and health information). The trainings took place in Tamale and Walewale. To strengthen practical IRS skills, 33 district health officers worked during the campaign as supervisors and used smartphone-based checklists for supervision and submitted 660 inspection forms by the end of the campaign.

The project trained 158 CHNs to assist with community mobilization. The project district coordinators and DHPOs (the CHNs’ immediate supervisors) facilitated day-long trainings conducted simultaneously in each IRS district. All CHNs assisted with mobilization in their assigned areas throughout the campaign. During the IRS off-season, the CHNs will continue including IRS messages in their routine community outreach activities, and focusing their efforts specifically on communities that have had consistently low IRS coverage.

In October 2019, the VectorLink Ghana Environmental Compliance Officer (ECO) traveled to Malawi to support that country’s PMI VectorLink program with final preparation for its spray campaign (vehicle inspection, construction of mobile soak pit, final site inspections, and TOT) and to train the newly hired ECO.

In January 2020, the VectorLink’s Vector Control Director, based in the US, held a three-day internal course for district coordinators and technical leads on trainer facilitation skills. The goal of the workshop was to equip the VectorLink Ghana team to effectively plan, prepare, facilitate, and evaluate IRS trainings.

2.8 GENDER MAINSTREAMING

VectorLink Ghana continued integration of females into IRS and creation of a safe work environment for all. The project focused on recruiting more females into IRS supervisory roles. One challenge to recruiting females for the field supervisor position was women’s lack of motorcycle driving skills. Otherwise qualified females who lacked the skill were recruited as site managers, a position that does not require the use of motorcycles. In 2020, the percentage of females in supervisory roles increased by 15.1% (Table 6).

TABLE 6. SUMMARY OF GENDER-RELATED INDICATORS, 2019-2020

Gender Indicator	Females Trained to Support IRS	Females Hired to Support IRS	Females Hired in Supervisory Roles†	Female SOPs Hired	Female TLs Hired
2019	17.6% (400)	18.1% (469)	22.3% (53)	22.6% (144)	26.2% (33)
2020	19.3% (523)	20.9% (551)	24.0% (61)	31.1% (200)	28.5% (37)
Yearly Change	30.8% (123)	17.5% (82)	15.1% (8)	38.9% (56)	12.1% (4)

Following the VectorLink Ghana lead on female integration into IRS, AngloGold Ashanti Ghana Malaria Control Ltd., the Global Fund IRS implementing organization in Ghana, rolled out female recruitment for its IRS campaign at full scale in 2020 after testing it in 2019. To ensure a harassment-free environment, all VectorLink seasonal workers signed an anti-sexual harassment policy. The policy includes information on a direct call-line for reporting harassment to the Abt Home Office. The project Gender Focal Person defined the purpose and use of the call-line to all participants during the TOT for explanation during subsequent trainings of field teams. The project also displayed 4ft x 5ft posters of the PMI Anti-Sexual Harassment Guidelines at all operations sites and sent out regular SMS messages to all workers to reinforce the guidelines. No incidents of harassment were reported at any of the sites during the campaign.

3. ENTOMOLOGY

This year's campaign offered the project an opportunity to monitor the decay rate and impact of three different insecticide formulations on entomological indices of malaria transmission within the same spray season. VectorLink Ghana sprayed Actellic® 300CS with the active ingredient of pirimiphos-methyl in MMD, SumiShield® 50WG with active ingredient of clothianidin in BND, KAD, WMD, and YND, and Fludora® Fusion, a mixture of clothianidin and deltamethrin, in EMD, GUD, KUD, and TSD.

In line with the project's objective of implementing high-quality IRS operations, spray quality tests were carried out within the first three days of the spray campaign in each sprayed district. One community was tested for each district. The communities tested were: Bugyanga (MMD), Bunbuna (BND), Bunbuna-Nasuan (YND), Cheyohi (KUD), Garache (GUD), Njobilbo (TSD), Wulugu (WMD), Yapala (EMD), and Yipili Naa Fon (KAD). Four houses (two with cement and two with mud, the predominant surface types) were purposefully selected in each community to represent structures sprayed by different SOPs and spray teams.

Standard WHO wall cone bioassays were conducted according to the project's Standard Operating Procedures for cone wall-bioassays (SOP009/01) to assess the quality of work done by the different spray teams. The bioassays were conducted using both *An. gambiae* Kisumu strain and wild *An. gambiae* s.l. across all sites except in Yipili Naa Fon (KAD), where only Kisumu strain was used because not enough wild larvae were available to rear for the test.

Spray quality in animal shelters was also tested in the Fludora® Fusion-sprayed Cheyohi (KUD) and Gabagalan Fong (EMD) communities, and the Actellic® 300CS-sprayed Katigri (MMD) community.

To assess the fumigant effect of the sprayed insecticides on mosquito species (Kisumu strain and wild *An. gambiae* s.l.), 10 mosquitoes from each species were introduced into 15x15x15 cm cages mounted 10cm from the sprayed wall surfaces at the time of the assays (i.e., exposure time of 30 minutes). The cages were hung from the ceiling.

Results: The results indicate that Actellic® 300CS killed 100% of the exposed wild *An. gambiae* s.l. and Kisumu strain mosquitoes, respectively, after the standard 24-hour holding period (Annex B). The results from the bioassays in the Fludora® Fusion-sprayed communities were similar to those recorded for the SumiShield® 50WG-sprayed communities. In the bioassays in Yapala (EMD) and Gariche (GUD), 100% mortalities were recorded at 24 hours post exposure on most surfaces. However, in Cheyohi (KUD) and Njobilbo (TSD), 100% mortalities were recorded after 48 hours. All three insecticides showed a fumigant effect on both the Kisumu strain and wild *An. gambiae* s.l. Results from the bioassays in the animal shelters also showed mortalities reached 100% within 24 hours post exposure, across all tested sites.

Discussion and Conclusion: The results above indicate adequate dosing and uniformity in spraying by different spray teams. The test results also show that all three insecticide formulations have a fumigant effect. However, the effect varied across different houses, which could be due to the amount of aeration in a particular room. Despite the high mortalities recorded from the bioassays, the project team continued to closely supervise the spray teams throughout the campaign to ensure that they were correctly applying the insecticides consistently on the wall surfaces as trained. Data on residual efficacy will be reported in semi-annual and annual reports.

4. ENVIRONMENTAL COMPLIANCE

4.1 IRS CAMPAIGN ASSESSMENTS

The project implemented the 2020 IRS campaign under a new SEA approved in March 2020. The SEA is valid for the period of 2020–2025 and authorizes the use of five WHO-recommended classes of insecticides: pyrethroids, carbamates, organophosphates, neonicotinoids, and pyrroles.

The ECO worked with the Regional EPA and District Environmental Health Officers (DEHOs) to oversee all environmental compliance activities before, during, and after the campaign. The home office Environmental Compliance Manager provided technical assistance for the process. VectorLink Ghana continued to use the Environmental Mitigation and Monitoring Plan as the guide for corrective actions to mitigate potential environmental impacts. The Environmental Mitigation and Monitoring Report in Annex C describes mitigation actions the project has taken to achieve safe and efficient spraying.

As part of the initial Pre-spray Environmental Compliance Assessment, VectorLink Ghana assessed all IRS facilities (storerooms, wash areas, soak pits) three months ahead of spray activities. Upon completion of the assessment, the ECO shared a worklist of required upgrades and improvements with the operations team to ensure that renovations were completed on schedule.

For the 2020 campaign, the project prepared 26 operations sites with 29 fixed soak pits. Two new fixed soak pits and a mobile soak pit site were in the expansion district of TSD. The new fixed soak pits used the improved design, with plastic sheets lining the walls, a metal cover of the bio-beds, and a topmost layer of large stones as prescribed in the revised 2020 PMI Best Management Practices (BMP) Manual. One fixed soak pit, also with the improved design, was provided at WMD. Finally, the project de-silted eight fixed soak pits initially constructed in 2017 to ensure better efficiency. VectorLink Ghana continued to use mobile soak pits to supplement the fixed soak pits. The project deployed a total of 16 MSPs, comprising 10 original (mobile soak pit I) and six of large capacity (mobile soak pit II, 45–50 L capacity) in the nine districts. Three of the mobile soak pit II were installed at BND, KAD, and TSD to support the fixed soak pit sites in those districts that had over 25 SOPs, the maximum number allowed in the pre-wash area. During the final assessment, the project together with the EPA and DEHOs identified suitable locations for installation of the remaining mobile soak pits in the communities. The project team also used the final assessment to verify completion of all refurbishments and authorize the distribution of insecticides to the operations sites.

To ensure a healthy workforce throughout the campaign, the project conducted pre-campaign medical screenings for all candidates for field positions as well as pregnancy tests for the female candidates. The pregnancy tests were repeated after 30 days, during the spray campaign. TLs conducted daily health checks using a special questionnaire to ensure that all SOPs were fit before heading to the field. Completed health checklists were filed at the district level.

The project addressed recommendations included in USAID's 2019 *Environmental Compliance Field Evaluation for IRS Report* to improve the environmental protection of beneficiaries and implementers of IRS. Specifically, VectorLink Ghana emphasized the importance of household preparations to all IRS cadres during training and stressed the role of TLs, field supervisors, and SOPs in mobilizing and assisting beneficiaries to empty the rooms. The team introduced the marking of plastic cover sheets with yellow tape to ensure that the exposed side was always on the outside when covering a household's items. VectorLink Ghana invited a Goizper technical representative to lead the sprayer maintenance session at the TOT. Adequate sprayer spare parts were procured and made available at all sites. District spray teams carried out weekly calibrations and oiling of the sprayers to ensure good functionalities throughout the campaign.

The VectorLink Ghana team together with government partners carried out mid-season inspections at the operations sites and in the field. The ultimate goal was to ensure ongoing compliance with prescribed safety requirements and to build in-country capacity to sustain IRS implementation. Site managers, after receiving feedback from inspections, addressed all “red flags” and solutions during morning assemblies.

4.2 INCIDENT REPORTS

VectorLink Ghana aimed to have zero incidents during the campaign, but it recorded four incidents, as described in Table 7.

TABLE 7. 2020 PMI VECTORLINK GHANA INCIDENT REPORT SUMMARY

Incident ID	Description of Incident	Location
GH-032320-001	Road Accident: Three armed men robbed the driver of a rented bus on the way to the Nabuli site.	Nabuli (GUD)
GH-041420-002	Health and Safety: A snake bit a packer while he was preparing a room for spraying.	Sung (KAD)
GH-042320-003	Theft: An SOP was found to have stolen two bottles of Actellic® 300CS insecticide.	Yikpabongu (MMD)
GH-042720-004	Theft: Two SOPs misappropriated four sachets of SumiShield® 50WG.	Karaga (KAD)

To mitigate the risk of insecticide pilferage and data falsification, the project implemented a number of processes: (i) Each seasonal worker who would have access to insecticide had to completed a guarantor form with the name and contact information of two local or religious leaders or other prominent people in the community at the time of signing the work agreement. The purpose of the guarantor form was to ensure good behavior. (ii) Supervisors conducted spot checks of Daily Spray Operator forms to verify whether the number of structures recorded as sprayed tallied with the expected number of insecticide bottles/sachets used. (iii) The project serialized each insecticide bottle/sachet with a unique number and required recording it on a Spray Operator form against the number of the structure for which it was opened. Each TL had to sign against the serialized insecticide units during issuance in the morning and reconciliation at the end of the day; TLs tracked distribution of insecticide against each SOP in the team. (iv) VectorLink Ghana posted “Insecticide Theft and Data Falsifications ‘Prison’ Warning” posters at all sites. (v) Any seasonal worker implicated in data falsification and/or insecticide theft or misuse faced immediate dismissal and loss of wages. The project reported the cases to the police for further action. Seasonal workers involved in such incidents are ineligible for rehire in future IRS campaigns.

4.2.1 DEMOBILIZATION AND WASTE MANAGEMENT

VectorLink Ghana decommissioned all 26 sites and moved all spray equipment and materials from the operations sites to the respective district stores within two weeks after the 2020 campaign. The project disposed of the solid waste and moved all contaminated waste materials (damaged hand gloves, used nose masks, and empty insecticide bottles and sachets) to the regional medical stores in Tamale. The ECO led the post-spray season inspections at all the operations sites from May 25 to June 2, 2020 to ensure that temporary storage facilities had been cleaned; soak pits properly closed, cleared of vegetation, and covered; and no IRS-related hazardous material remained at the sites. Plastic waste (Actellic® 300CS bottles, hard hats, face shields, broken Goizper pump parts), and empty cardboard boxes will be recycled. The project will most likely use Cyclus Elmina Plastic Recycling Ltd for plastic incineration and Fine Print Ltd for paper recycling in July-August. Contaminated waste (insecticide sachets, nose masks, and exhausted granulated activated carbon from MSPs and charcoal from de-silted old soak pits) will be incinerated in July 2020. Contracted waste management companies upon completion of their task will issue certificates of completion to document incineration, recycling, and all other waste disposal methods.

4.2.2 COVID-19 RELATED EFFORTS

To ensure that the vulnerable population is protected against malaria, IRS implementation continued during the COVID-19 pandemic with strong adherence to risk-mitigating measures. VectorLink Ghana increased the number of hand-washing stations (Veronica buckets) at each operations site. The project provided all spray teams alcohol-based hand sanitizers, and bleach for disinfecting vehicles' doorknobs and other equipment; it also introduced social distancing rules. Emergency numbers and messaging on COVID-19 were posted at all sites. Through the SMS platform, VectorLink Ghana sent out reminders on COVID-19 prevention and reinforced them to all seasonal workers during morning mobilization on daily basis. In collaboration with the GHS, the project developed a contingency protocol to use if a suspected or positive case was identified among the teams. The District Assemblies disinfected six out of 26 operations sites through the national disinfection exercise conducted at the time of the campaign. The NMCP and the two regional health directorates fully supported the IRS campaign and used the project's experience integrating COVID-19 protection measures and messaging as a model for other interventions.

5. MONITORING AND EVALUATION

5.1 DATA COLLECTION

In 2020, VectorLink Ghana used two approaches for capturing spray data: mobile data collection using Samsung tablets loaned by the NMCP for use in TSD and Zanteli site in GUD, and paper-based data collection in all other districts and sites. In both approaches, the project used standardized data collection forms designed to capture all core PMI indicators (Table 8). All SOPs received training on paper-based data capture and quality; those who used tablets received additional sessions on mobile data collection. During the spray campaign, SOPs captured data on the Daily Spray Operator form. At the end of each spray day, TLs verified the SOP forms for completeness and accuracy when completing the Team Leader Summary form and then handed the forms over to the field supervisors. The field supervisors reviewed and forwarded the SOP forms to the data center for final review and entry of the data into the VectorLink Collect database.

TABLE 8. DATA COLLECTION TOOLS

Tool	Purpose	Enhancement	Person Responsible
Daily Spray Operator Form	To report standard spray data together with insecticide use.	Added a column to record spraying of animal shelters	SOP
Team Leader Summary Form	To check the data accuracy in the SOP form and to provide a daily summary of his/her team's work.	N/A	TL

5.2 DATA ENTRY

Paper-based data entry was done in two stages: data entry assistants (DEAs) had 24 hours to enter Totals Data for the day and 48 hours to enter Details Data. The M&E manager reported daily results of totals to the home office and VectorLink Ghana operations teams for real-time operations oversight and decision making within 12 hours.

5.3 DATA QUALITY ASSURANCE

To ensure data quality, the project has protocols for all levels of data handling, management, and reporting. By the established protocol, SOPs are the only people allowed to record spray data using strict structure counting and marking procedures. TLs, field supervisors, M&E assistants, district operations coordinators, and other supervisors conduct regular spot checks of the data while in the field. The following are some of the data quality assurance tools and approaches that VectorLink Ghana implemented:

- Standardized data collection tools and comprehensive training for all seasonal workers on data collection and entry.
- Daily Team Leader Summary Form to summarize spray results for each SOP and identify and correct data capturing errors.
- Data collection verification (DCV) tool used in sampled communities to verify SOP-collected data.
- Double-entry process for spray data to ensure checks and balances between Totals and Details Data.

- VectorLink Collect’s data-cleaning tool that matches the two independent data entries and highlighted entry errors for correction.
- System of validation checks in the VectorLink Collect database.
- Secure storage of all hard copies of spray and mobilization data forms in durable binders.

5.4 VECTORLINK COLLECT

In prior years, VectorLink Ghana collected all data using MS Access software. In 2020, VectorLink Ghana rolled out the VectorLink Collect database to store, visualize, and analyze spray data. The database was created on the free and open-source District Health Information Software 2 (DHIS2), hosted online by BAO Systems and managed by the Abt home office team. The new database has multiple advantages including an interactive dashboard to have a real-time view of spray progress, and ability to generate pivot tables to design customized reports.

The M&E Manager and IT/Database Manager attended a regional training on the database in Accra in January 2020. Following the training, the VectorLink Ghana team trained 45 DEAs and 17 M&E assistants on the new database and mobile spray data collection protocol. Out of 62 trainees, the project hired 37 DEAs and 12 M&E assistants for the campaign.

Prior to the campaign, the M&E and operations teams gathered the needed metadata that would enable roll-out of the database (geographical information, SOP codes, and spray targets to sub-district level). The home office team then set up the database with VectorLink Ghana metadata to enable entry and reporting.

DEAs carried out data entry on a daily basis. All forms that were found to have errors were returned to the field for correction. Duplication of IRS numbers was the most common error identified, a result of revisited structures not being captured as revisits; once identified, ‘revisit’ was indicated on the Daily SOP form and the data were edited in the database. Main cleaning of duplicate spray data occurred post-spray, after DEAs completed all data entry. The project used a three-stage cleaning process built into the database: the IRS Duplicate Finder, Spray Variance Report, and the Mop-up Tool.

As a first-time user of the VectorLink Collect, VectorLink Ghana encountered challenges that reduced productivity of the overall data management process during spraying. The VectorLink Collect system largely depends on uninterrupted internet connectivity because it is a cloud-based platform with a server located in the United States. When internet connectivity was poor, DEAs had no option but to pause data syncing and wait until internet connectivity was restored to continue data entry. This sometimes led to incorrect feedback to the spray teams and inefficient decisions for the campaign. Other challenges included:

- Any changes DEAs made during data entry and/or cleaning took a long time to take effect, on average of 4-5 hours. This caused DEAs to pause data cleaning and wait for the changes to appear in the database so they could check if they were on the right path.
- No provision for changing an incorrectly selected data unit from the metadata (e.g., a community) before the entire event is entered. For example, if a DEA mistakenly entered data for Community A, instead of Community B, s/he could not make the correction by switching the community name and saving the entry but rather had to delete all the spray data for Community A, and enter it anew for Community B.
- The database server intermittently went offline and slowed down data entry and cleaning, thereby affecting availability of complete data for decision making.
- Different access privileges initially caused different users to see different data on the dashboard. This created confusion in interpreting spray results and misled guidance to the operations team.
- Some core indicators (like insecticide usage, structure per SOP) were not presented correctly on the dashboard, making it difficult for end-users to interpret the results.
- Inability of the system to identify duplicate IRS numbers during entry, without running the cleaning tools and interrupting data entry process. This caused a large backlog in data cleaning. This was a new

development for the team as compared to the legacy MS Access database, when DEAs were able to identify duplicate numbers during data entry and clean them up-front.

To address these challenges, VectorLink Ghana will re-assess the level of effort required for timely data entry and cleaning and consider adding additional DEAs and/or revising daily tasks and duties of the current number of assistants. Technological improvements to the database are also crucial to enhance system efficiency and to avoid inappropriate decision making.

5.5 MOBILE DATA COLLECTION INITIATIVE

As part of its efficiency and cost-saving efforts, VectorLink Ghana rolled out digitized spray data collection using a mobile version of the DHIS2-based VectorLink Collect application. The goal of mobile data collection was to improve data-processing and reporting time while maintaining real-time data availability for operational decision making during the spray. Building on lessons learned from other IRS countries, VectorLink Ghana implemented mobile data collection with 95 SOPs in three sites: Tatale and Kandin (TSD) and Zantelli (GUD). Prior to the campaign, the project team configured each tablet (8GB, 5th generation Samsung Galaxy Tab A Tablet) with a mobile version of the DHIS2 application. The project borrowed the tablets from the NMCP, at no cost. VectorLink Ghana provided 95 registered SIM cards for each tablet and distributed 90 power banks for recharging the tablets while in the field. TLs carried paper copies of the Daily Spray Operator form to the field only as back-up in case the mobile app failed at the time of data recording.

At the end of each day, the TLs (who were in charge of five SOPs) checked each tablet for any validation errors, incomplete forms, and forms with incorrect metadata details. After all errors were corrected, the SOP brought the tablets back to the site for DEAs to review the data and sync them into the database. If the DEAs found any errors, the site manager or field supervisors contacted the SOP involved for clarification and correction. When a site completely lacked mobile network coverage, the tablets assigned to that site were transported to the nearest community with network coverage and internet connectivity for spray data synchronization to take place.

In addition to individual data entry errors such as selecting an incorrect SOP code or a community, many SOPs experienced common challenges such as the screen-touch sensitivity of tablet screens, delay in capturing GPS coordinates of structures, and network and internet connectivity in some operation sites. With enhanced training and further improvements to the mobile application, VectorLink Ghana plans to expand mobile data collection.

5.6 MHEALTH

In the 2020 spray campaign, VectorLink Ghana continued using mobile phones for supervision and job aids through technological platforms such as CommCare, TextIt, and Open Data Kit (ODK).

For the phone-based supervision, the project used ODK-based checklists. Specifically, the ECO used the Environmental Compliance checklists for environmental inspections. During spraying, project supervisors used the four checklists identified above in Section 2.3.4, IRS Supervision. Field supervisors and government partners used the same supervisory checklists, but they were maintained on the CommCare platform managed by Dimagi.

In 2020, 9,816 inspections were conducted using smartphones, against 9,752 inspections in 2019. Users of the CommCare platform completed 9,333 inspections and users of ODK completed 483 inspections. The same supervisory checklists were available on CommCare and ODK platforms. In total, 544 red flags were observed, with 492 (90.4%) reported through the CommCare platform and 52 (9.6%) through the ODK. Some red flags were erroneous responses due to misunderstanding of the questions. In response to actual red flags, some SOPs received on-the-spot support for leaking pumps, guidance on sprayable surfaces, and reminders not to eat while in the field.

VectorLink Ghana continued use of SMS to send out important job aids and reminders. Messages sent to all spray actors included communications on safety and an incident-free environment: *Safety during operations and Zero Incidents are Paramount to IRS*. Because the project had to manage the campaign during the emerging COVID-19 pandemic in Ghana, the team set up recurring reminders to all seasonal workers on this: *Protect yourself and your people from COVID-19. Keep 2 meter distance from each other and wear face mask all the time: in a bus, community or IRS site!*

5.7 RESULTS

The VectorLink M&E indicators matrix in Annex D provides results for core and other spray indicators for the 2020 campaign. Details for main indicators are presented below.

5.7.1 SPRAY COVERAGE AND POPULATION PROTECTED

During the spray campaign, SOPs found a total of 366,283 structures and sprayed 339,139, for a spray coverage of 92.6%. This year, SOPs found 19,998 more structures than targeted (346,285). Reasons for finding more structures include: improvement in SOP training and adherence to structure markings and counting protocol; an early start of the rainy season, which forced some households to sell stored farming goods and made some previously ineligible structures eligible for IRS; and the return of migrants from big cities like Accra and Kumasi due to the COVID-19 lockdown, which made more eligible structures available for spraying.

SOPs recorded 1,020,199 people living in the structures found, and IRS protected 965,467 (94.6%) of them from malaria (persons living in the sprayed structures). This includes 21,295 pregnant women and 161,750 children under 5 years of age. Details on the number of structures found and sprayed, and populations protected, by district, are presented in Table 9.

TABLE 9. SUMMARY OF 2020 SPRAY RESULTS

District	Structures			Population			Pregnant Women Protected		Children Under 5 Years Protected	
	Found by SOPs	# Sprayed	% Sprayed	# Protected	# Not Protected	% Protected	# protected	% protected	# protected	% protected
BND	42,662	40,410	94.7%	98,280	4,336	95.8%	1,659	1.7%	12,022	12.2%
EMD	78,740	74,219	94.3%	207,978	8,566	96.0%	4,484	2.2%	34,100	16.4%
GUD	46,069	43,635	94.7%	130,986	4,939	96.4%	3,143	2.4%	24,456	18.7%
KAD	36,719	32,763	89.2%	101,278	7,700	92.9%	2,557	2.5%	19,262	19.0%
KUD	38,247	35,006	91.5%	97,913	6,330	93.9%	1,986	2.0%	15,922	16.3%
MMD	24,743	22,173	89.6%	66,061	5,873	91.8%	1,538	2.3%	12,558	19.0%
TSD	24,638	23,466	95.2%	67,450	2,139	96.9%	1,623	2.4%	11,812	17.5%
WMD	58,816	52,099	88.6%	153,758	14,257	91.5%	3,462	2.3%	25,781	16.8%
YND	15,649	15,368	98.2%	41,763	592	98.6%	843	2.0%	5,837	14.0%
Total	366,283	339,139	92.6%	965,467	54,732	94.6%	21,295	2.2%	161,750	16.8%

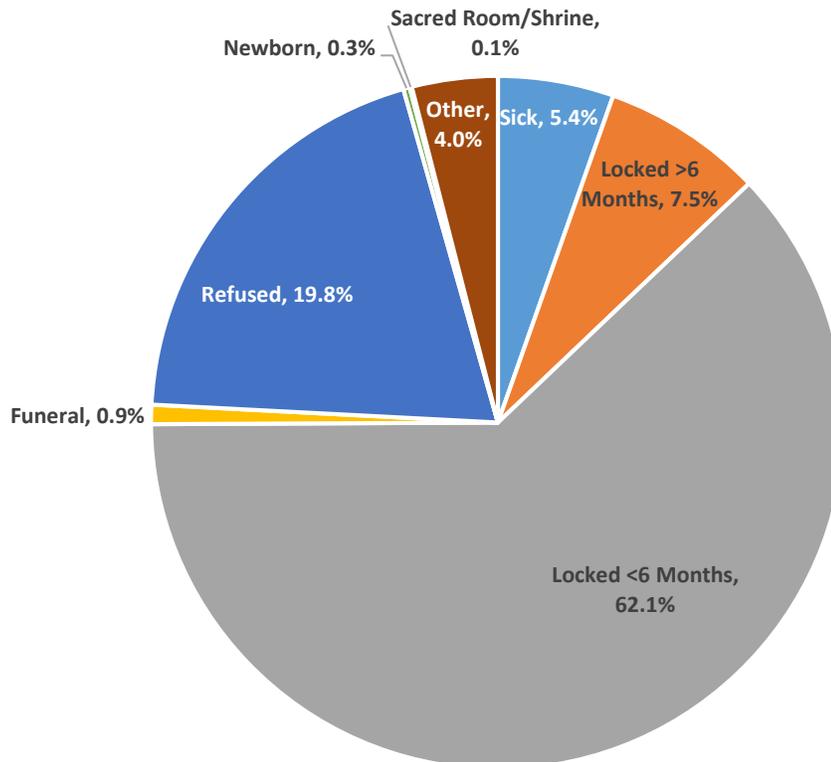
In December 2019, the project contracted a private local firm, GeoGrafix, to carry out a digital map verification exercise in GUD. GeoGrafix identified 49,707 structures as IRS-eligible according to the VectorLink Ghana definition. The project found 3,638 structures fewer (46,069) during the spray campaign than GeoGrafix did. A detailed analysis indicated that the communities in the VectorLink and GeoGrafix datasets matched, except for six with a total of 133 communities: two communities were missing from the GeoGrafix list and four were

missing from the VectorLink Ghana list. The discrepancy might be explained by the dynamics of structure use due to weather seasonality in the Northern Region, where GUD is located. Almost all households are multi-use, containing sleeping places and storage facilities. At the time of the verification exercise, most of the households had not harvested their farm produce hence the structures were available and counted as eligible for IRS. During the dry season, households often renovate rain-damaged structures, which might be considered ineligible and therefore not counted at the time of IRS campaign. Households also construct new structures to meet the accommodation needs of the family.

5.7.2 REASONS WHY STRUCTURES WERE NOT SPRAYED

Out of the 366,283 structures found, 27,144 (7.4%) were not sprayed. As shown in Figure 3, the three most common reasons for not spraying structures were: structures locked for less than six months (16,597); households refused IRS (5,290); and structures locked for more than six months (2,002). This breakdown is similar to that of 2019 with structures locked for less than six months the most common reason (62.1% in 2020 and 59.6% in 2019) and refused the second most common (19.8% in 2020 and 24.1% in 2019).

FIGURE 3. REASONS FOR NOT SPRAYING STRUCTURES



6. CHALLENGES AND RECOMMENDATIONS

Overall, the 2020 IRS campaign was successful at achieving its spray targets. Nevertheless, VectorLink Ghana encountered challenges during the operations. Based on the lessons learned from dealing with these challenges, VectorLink Ghana made recommendations for future campaigns.

- Challenge:* The spray teams encountered locked structures and household refusals of IRS. One of the most common reasons for the locked structures were households leaving homes early for farm work. Reasons for refusals included households' unwillingness to prepare rooms. Some residents claimed that insecticide would stain the walls and have a strong odor, or lack thereof. Some people who did not want their rooms to be sprayed claimed they were planning to plaster the walls or even rebuild the rooms, and spraying would waste the insecticide. Because 2020 is an election year in Ghana, some beneficiaries felt the program was a government initiative and because they opposed the government, they opposed the project.

Recommendation: To address the issue of locked structures and refusals, the project will continue the strategy of early and prolonged community engagement to intensify mobilization. The project will focus attention on creating targeted messages to address the reasons for refusals. It will fully engage communities and their leadership in all communication and mobilization activities to find sustainable solutions to avoid locked structures (e.g., entrust keys to household members before leaving for farms).
- Challenge:* The project piloted mobile data collection in Zanteli site (GUD) and the whole of TSD. Some SOPs, mainly in GUD, did not follow instructions to sync the collected data from the tablets to a cloud-based server. This resulted in data missing from the database, which made planning of revisits difficult and resulted in SOPs being dispatched to already sprayed communities; it also delayed on-time reporting of spray progress.

Recommendation: The project will review its training content to include more practical sessions during SOP training on mobile data capturing and syncing. It will continue to review the challenges and successes of the pilot exercise and possibly scale up to all districts in the future.
- Challenge:* As in previous campaigns, chiefs and other community and local leaders interfered with SOP recruitment. They used recruitment of their people as a condition of accepting IRS. Local leaders in GUD threatened to sabotage project operations if the project did not recruit their people.

Recommendation: Despite interference in SOP recruitment by chiefs and political leaders, VectorLink Ghana will continue to recruit seasonal workers based on project-required selection criteria. It will continue engaging with government partners and stakeholders so that they have a better appreciation of the recruitment system. IEC assistants will continue engaging community leadership for support to address the threat of sabotage from the local government officials.
- Challenge:* To ensure comprehensive data capture by structure, the project introduced a protocol for marking every eligible structure with a number, whether it was sprayed or not. The time allocated to this process during the SOP training was not sufficient for the trainees to fully embrace and practice the protocol. Although the project made significant changes in recruiting and training SOPs and TLs on the data capturing and structure-marking protocols, many of them did not properly follow the protocols, especially during revisits.

Recommendation: The project will review its training content to include more practical sessions for SOPs

on data capturing with real-life revisit situations incorporated.

5. *Challenge:* For the second year, VectorLink Ghana followed the project guidance to assign three spray teams to each field supervisor as a cost saving measure. In some operations sites, one field supervisor was responsible for supervising more than three teams. Having fewer field supervisors affected supervision. If a supervisor had to visit more than one community in a spray day, TLs—already busy with their own tasks—had to step in to provide additional supervision. The limited supervision resulted in some spray teams not meeting daily spray targets and some poorer household preparation. *Recommendation:* The project will continue to assign dedicated supervisors to the mobile soak pit sites, which are small stand-alone operations sites, and consider increasing the number of supervisors at those sites with more than three teams. VectorLink Ghana will also continue to do thorough supervision and monitoring of these smaller operations sites.
6. *Challenge:* Household preparation continued to be a challenge mainly in peri-urban communities, where residents are often off at work when the spray team arrives. They also have more possessions than rural residents, and some refused to prepare their houses for spray because of the burden of packing out and re-packing. *Recommendation:* To address homeowner preparation for spraying in peri-urban communities, the project will continue engaging packers and continue stationing some spray teams in the communities for the entirety of the campaign. In 2020, the project successfully carried out this model in seven towns. Also, the project will continue to push for the integration of IRS outreach into the routine health promotion activities through CHNs. For better impact, the project will develop a work structure (schedule) for all CHNs who will be involved in the next campaign to ensure they cover as many communities as possible.
7. *Challenge:* Private developers are encroaching on land near operations sites in EMD, KUD, and YND. By the next campaign, the sites may be non-compliant with environmental safety and security standards. Since 2018, the project has not stored insecticides in Dalun (KUD), and Sakogu and Langbensi (in EMD) because new residences and water sources have been placed too close to the IRS sites. This forced the team to transport insecticides to those sites each day. In EMD, the District Assembly threatened to take all operations sites for their use, and this disturbed planning of the spray calendar in the district. *Recommendation:* To deal with developers' encroachment on operations sites, the project will consider relocating affected sites to areas that meet the project environmental compliance standards for future campaigns. In EMD, the project is working with the regional health directorate and traditional authorities to convince the District Assembly to sign a memorandum of understanding that allows the project to continue using the sites.
8. *Challenge:* VectorLink Ghana continues to be challenged by relatively few female workers in supervisory roles due to factors such as inability to ride motorcycles, and by retention of female workers due to marriage and childbirth, education, cultural issues, and so forth. *Recommendation:* To increase female participation, the project will increase its efforts to recruit more females by teaching them to ride motorcycles and by adopting a mentorship plan to retain them, with elements such as reassigning pregnant females to safe and convenient positions.
9. *Challenge:* The emergence of COVID-19 during the spray campaign was a significant challenge. Spray teams encountered many residents from southern Ghana before and immediately after the partial lockdown. These residents brought misinformation, rumors, and fears about the virus, which could have triggered rejections of IRS and help spread the virus itself. Other challenges related to COVID-19 included:
 - Project staff could not conduct the usual in-person weekly spray progress meetings.

- The project limited participation in IEC community meetings to 10 people and focused on community leaders rather than the general community members. Video shows were cancelled because they would have violated the president’s directive that limited social gatherings to not more than 25 people.
- Spray teams worked with fear of becoming infected, although the project provided necessary logistics, protocols, and personal protective equipment as preventive measures
 - SOPs encountered a lot of children at home during spray visits because schools were closed to contain the spread of the virus. This made home preparation challenging.

Recommendation: If COVID-19 continues during the 2021 campaign, the project will maintain the measures and strategies it introduced in 2020 for implementing IRS while avoiding the spread of the virus. Most measures involve social distancing, increased hand washing, and appropriate dress:

- Replacing in-person weekly spray progress discussions with meetings via technology (WebEx, WhatsApp, and other platforms).
- Adapting training schedules and venues to allow for social distancing and compliance with any limitations of movements and/or group gatherings.
- Adjusting IEC outreach practices and other communication of IRS-related messages to align with the national guidelines on social interaction.
- Wearing full personal protective equipment even while in a vehicle.
- Requiring the use of face masks at all times and use of examination gloves during room preparation and data capture.
- Requiring SOPs to keep a distance of 2 meters away from household members during data collection.
- Enabling frequent hand washing at each site and office by providing extra “veronica buckets.”
- Revising transportation and personal protective equipment needs for the campaign.
- Developing a contingency plan for dealing with any COVID-19 cases identified among seasonal workers.
- Developing a protocol to formalize social distancing.

ANNEX A. POST-SPRAY INVENTORY OF KEY IRS SUPPLIES

INTERNATIONAL PROCUREMENT

ITEM DESCRIPTION	Unit	Balance Before	Quantity Procured	Total	Quantity Used	Quantity Damaged/ other purpose	Quantity After Campaign
INSECTICIDE							
Actellic® 300CS	Bottle	4148	0	4148	4146	2	0
Fludora® Fusion	Sachets	0	41730	41730	41249	0	481
SumiShield® 50WG	Sachets	5687	25440	31127	31103	4	20
PERSONAL PROTECTIVE EQUIPMENT							
Coverall	Pcs	1936	26	1962	1932	362	1600
Face Shield	Pcs	529	1380	1909	978	978	931
Hand Gloves (standard for Spray Operators)	Pair	521	1728	2249	1300	1300	949
Hard Hat	Pcs	880	48	928	883	48	880
Head Gear	Pcs	906	50	956	929	43	913
Heavy Duty Gloves (Arm length for Washers)	Pair	134	72	206	106	88	118
Nose Mask	Pcs	1815	30960	32775	31107	29925	2850
GOIZPER PUMP & ACCESSORIES							
Goizper Ik Super Pump (10 Ltrs)	Pcs	768	0	768	765	4	764
Check Valve (chamber Valve)	Pcs	80	0	80	4	0	76
Chamber Cover	Pcs	80	0	80	47	0	33
Chamber Cover Screw	Pair	45	35	80	39	0	41
Colar Seal (Plunger cap)	Pcs	209	0	209	37	0	238
Complete Handle (Triger)	Pcs	165	0	165	59	0	106
Complete Lid	Pcs	1	26	27	1	0	26
Filter with Gasket	Pcs	70	0	70	25	0	79
Hose	Pcs	111	0	111	28	0	83
IK Super Service Kit	Set	2	156	158	131	0	27
Lance Tube	Pcs	15	62	77	23	0	54
Plunger	Pcs	111	4	115	91	0	24
Pressure Regulator (CFV)	Pcs	61	16	77	53	0	24
Nozzle Filter	Pcs	1011	1266	2277	445	0	1832
Nozzle Protector	Pcs	31	728	759	365	0	394
Nozzle Tip	Pcs	1342	935	2277	1008	0	1269

Strap	Pcs	6	2	8	2	0	6
Safety Valve	Pcs	81	0	81	1	0	92
Tighten Chamber Tool	Pcs	25	3	28	26	0	28

MOBILE SOAK PIT ITEMS

Activated Carbon (Charcoal 10 Kg)	Bag	16	0	16	8	0	8
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OTHERS

Barcode Scanner	Pcs	0	3	3	0	0	3
Barcode Sticker	Pcs	0	80000	80000	76862	101	3037

LOCAL PROCUREMENT

ITEM DESCRIPTION	Unit	Balance Before	Quantity Procured	Total	Quantity Used	Quantity Damaged/ other purpose	Quantity After Campaign
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PERSONAL PROTECTIVE EQUIPMENT

Apron	Pcs	138	16	154	118	3	151
Boot	Pair	787	281	1068	1028	67	1001
Cotton Socks	Pair	168	1792	1960	1796	1960	0
Life Jacket	Pcs	53	0	53	36	0	53
Neck Cover	Pcs	1815	10	1825	1635	282	1543

OTHER EQUIPMENT

Bathing Bucket	Pcs	89	24	113	109	35	78
Calculator	Pcs	121	86	207	191	37	170
Calibrated Cup	Pcs	21	14	35	28	4	31
Danger Sign	Pcs	152	3	155	149	17	138
Fire Extinguisher	Pcs	67	0	67	59	0	67
Flash Light	Pcs	399	0	399	170	160	239
Hand wash Bowl	Pcs	44	14	58	60	3	55
Head Lamp	Set	43	600	643	642	38	605
Heavy Duty Brush (for washing)	Pcs	67	18	85	59	20	65
Megaphone	Pcs	49	5	54	40	0	54
Mobilizers Vest	Pcs	1665	0	1665	1189	0	1562
Public Address System	Set	17	0	17	16	1	16
Pliers	Pcs	23	6	29	41	3	26
Rain Coat	Pcs	21	6	27	19	0	27
Rinsing Barrels	Pcs	203	0	203	189	0	203
Rope (Drying Line)	Pcs	29	11	40	39	12	28
Sand Bucket	Pcs	30	5	35	32	0	35
Screw Driver	Pcs	28	0	28	18	6	22
Shifting Spanner	Pcs	23	6	29	25	1	28
Shovel	Pcs	30	0	30	30	2	28
Solar Power supply	Set	0	1	1	1	0	1
Spray Bag	Pcs	750	159	909	799	185	724
Spread Sheet	Pcs	235	1406	1641	1550	1641	0
Stop Watch	Pcs	28	3	31	25	8	23

Tape measure	Pcs	15	12	27	23	3	24
Thermometer	Pcs	31	0	31	32	2	29
Wash Basin	Pcs	86	27	113	106	28	85
Waste Bin	Pcs	25	2	27	26	0	27
Water Cup (0.5 liter)	Pcs	601	109	710	675	151	559
Water Cup (1 Liter)	Pcs	63	27	90	79	10	80
Water Cup (2 Liters)	Pcs	18	42	60	53	17	43
Water Filter	Pcs	492	0	492	240	43	449
Water Jug	Pcs	110	0	110	86	34	76
Whistle	Pcs	54	0	54	24	16	38

CONSUMABLES

Bar Soap (Key Soap)	Pcs	83	768	851	784	0	67
Bathing Soap (Geisha)	Pcs	220	2592	2812	2791	0	21
Batteries (Dry Cell)	Pair	662	0	662	374	0	288

ITEM DESCRIPTION	Unit	Balance Before	Quantity Procured	Total	Quantity Used	Quantity Damaged/ other purpose	Quantity After Campaign
Chalk	Pck	2984	0	2984	664	0	2320
Empty Sack	Pcs	15	305	320	245	0	75
First Aid Kit	Set	63	75	138	87	0	51
Liquid Soap	Pcs	30	108	138	122	0	16
Nozzle Brush	Pcs	178	633	811	677	0	134
Powdered Soap (Omo)	Sachet	118	960	1078	1008	0	70
Sanitary Pad	Set	90	272	362	342	0	20
Towel	Pcs	74	918	992	901	0	91
Vaseline Gel	Pcs	64	840	904	897	0	7

PRINT MATERIALS

Daily Spray Operator Card	Pcs	6842	56000	62842	46611	6842	9389
Daily TL Summary	Pcs	2322	6478	8800	5145	2322	1333
DOS Form	Pcs	692	7100	7792	4636	692	2464
Delivery Book	Booklet	29	19	48	26	0	29
Goods Receipt Note	Booklet	8	0	8	0	0	8
IEC IRS Brochure	Pcs	443	0	443	443	0	0
IEC IRS Steps Poster	Pcs	1016	3442	4458	4458	0	0
IRS Spray Calendar	Pcs	1411	6019	7430	4440	0	2990
IRS HH No. Plate & Sticker	Pair	2611	15000	17611	13385	0	4226
Ledger Book	Pcs	2	38	40	36	0	35
MO1 Card	Pcs	1157	499	1656	1052	0	604
MSDS	Set	44	39	83	59	0	87
Performance Tracker	Pcs	0	27	27	27	0	0
PMI/VectorLink Anti Sexual Harassment	Pcs	21	7	28	27	9	19
Request Book	Booklet	53	19	72	40	0	38
Spray Operator's Guide	Booklet	432	356	788	644	205	583
Store Keeper's Guide	Booklet	50	50	100	37	0	100
Spill Response Procedure	Set	37	0	37	37	3	34
Stock Card	Pcs	1243	2852	4095	3789	0	306

Team Leader Guide	Booklet	198	0	198	90	15	183
USAID/ PMI Sticker	Pcs	382	0	382	282	0	100
Vehicle Log Book	Booklet	10	0	10	8	0	1
Well-dressed Storekeeper Poster	Pcs	26	0	26	26	8	18

MOBILE SOAK PIT ITEMS

Heavy Brush (for washing)	Pcs	15	10	25	25	4	21
Hoe	Pcs	15	0	15	8	7	8
Mobile Soak Pit Carrier	Pcs	37	15	52	12	48	4
Mobile Soak Pit Bucket (25ltrs)	Pcs	20	15	35	12	31	4
Napkin (Was Cloth)	Pcs	4	84	88	88	88	0
Shovel	Pcs	13	1	14	14	3	11
Tarpaulin (4mx4m)	Pcs	17	6	23	21	1	22
Wash Basin (Boot Wash)	Pcs	27	9	36	33	16	20
Water Barrel (60 Ltrs)	Pcs	47	16	63	57	14	49
Water Cup (1 liter)	Pcs	23	6	29	21	0	29
Water Cup (2 liters)	Pcs	0	21	21	21	18	3
Waste Barrel (100 Ltrs)	Pcs	16	13	29	13	8	21

ITEM DESCRIPTION	Unit	Balance Before	Quantity Procured	Total	Quantity Used	Quantity Damaged/ other purpose	Quantity After Campaign
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MOBILE PHONE FOR IRS FIELD REPORTING

Samsung Ch@T 222	Pcs	5	0	5	0	0	0
Huawei Y3	Pcs	10	0	10	0	0	0
Huawei Y5	Pcs	64	0	64	64	0	64
Samsung Galaxy J2 core	Pcs	14	31	45	45	0	45

ANNEX B. SPRAY QUALITY BIOASSAYS RESULTS

Sentinel site	Type of Surface and Test	Mosquito Species	Number Tested	Number of Days Post Exposure							
				Day1	Day 2	Day 3	Day 4	Day 5	Day 6	Day 7	
SumiShield®50WG (clothianidin)											
Bunbuna (BND)	Mud	Kisumu	57	100%							
		Wild	56	100%							
	Cement	Kisumu	53	100%							
		Wild	59	100%							
	Wood	Kisumu	40	100%							
		Wild	37	100%							
	Fumigant Effect	Kisumu	20	60%	80%	100%					
		Wild	20	55%	70%	94%	100%				
Bunbuna-Nasuan (YND)	Mud	Kisumu	58	100%							
	Cement	Kisumu	59	100%							
	Wood	Kisumu	38	100%							
	Fumigant Effect	Kisumu	20	0.0%	0.0%	100.0%					
Wulugu (WMD)	Mud	Kisumu	58	98.30%	100%						
		Wild	56	100%							
	Cement	Kisumu	57	100%							
		Wild	55	83.60%	100%						
	Wood	Kisumu	36	100%							
		Wild	34	73.50%	85.30%	100%					
	Fumigant Effect	Kisumu	19	0%	0%	28%	72%	100%			
		Wild	20	5%	5%	30%	37%	100%			
Yipili Naa Fon (KAD)	Mud	Kisumu	60	100%							
		Wild	30	100%							
	Cement	Kisumu	60	100%							
		Wild	30	100%							
	Wood	Kisumu	40	100%							
		Wild	20	100%							
	Fumigant Effect	Kisumu	30	66.7%	33.3%	100.0%					
		Wild	20	65.0%	15.0%	80.0%	100.0%				
Fludora® Fusion (clothianidin/ deltamethrin)											
Cheyohi (KUD)	Mud	Kisumu	60	100%							
		Wild	58	100%							
	Cement	Kisumu	58	100%							
		Wild	58	100%							
	Wood	Kisumu	40	87.50%	100%						
		Wild	39	87.20%	100%						

Sentinel site	Type of Surface and Test	Mosquito Species	Number Tested	Number of Days Post Exposure						
				Day1	Day 2	Day 3	Day 4	Day 5	Day 6	Day 7
	Fumigant Effect	Kisumu	20	0.0%	0.0%	40.0%	50.0%	100.0%		
		Wild	20	5.0%	0.0%	15.6%	100.0%			
	Animal Shelters	Kisumu	87	100.0%						
Yapala (EMD)	Mud	Kisumu	58	100%						
		Wild	57	100%						
	Cement	Kisumu	59	100%						
		Wild	55	100%						
	Wood	Kisumu	37	100%						
		Wild	39	100%						
Fumigant Effect	Kisumu	20	0.0%	0.0%	10.6%	70.0%	100.0%			
	Wild	20	0.0%	5.0%	16.1%	65.0%	100.0%			
Gabagalan Fong (EMD)	Animal Shelters	Kisumu	30	100.0%	100.0%	0.0%	0.0%	0.0%		
Njobilbo (TSD)	Cement	Kisumu	120	100%						
		Wild	120	96.70%	100%					
	Wood	Kisumu	40	80%	100%					
		Wild	40	95%	100%					
	Fumigant Effect	Kisumu	20	55.0%	70.0%	92.0%	98.0%	100.0%		
		Wild	20	0.0%	0.0%	80.0%	80.0%	85.0%	90.0%	100.0%
Garache A (GUD)	Mud	Kisumu	60	100%						
		Wild	60	100%						
	Cement	Kisumu	60	100%						
		Wild	30	100%						
	Wood	Kisumu	40	100%						
		Wild	40	100%						
Fumigant Effect	Kisumu	30	50.0%	60.0%	90.0%	100.0%				
	Wild	30	36.7%	0.0%	100.0%					
Actellic®300CS Pirimiphos-methyl CS										
Bugyanga (MMD)	Mud	Kisumu	87	100%						
		Wild	88	100%						
	Cement	Kisumu	30	100%						
		Wild	27	100%						
	Wood	Kisumu	39	100%						
		Wild	39	100%						
Fumigant Effect	Kisumu	20	100.0%							
	Wild	20	90.0%							
Katigri (MMD)	Animal Shelters	Kisumu	30	100.0%						

ANNEX C. IRS ENVIRONMENTAL MITIGATION AND MONITORING REPORT

Implementing Organization: Abt Associates Inc.

Geographic Location of USAID-funded Activities: Ghana

Period Covered by this Report: March 24 - April 28, 2020

Mitigation Measure	Status of Mitigation Measures	Outstanding Issues Relating to Required Conditions	Remarks
1a. Insecticide selection for any USAID-supported malaria program is subject to the criteria listed in the USAID Programmatic Environmental Assessment, country SEAs, and host country requirements.	All insecticides used for the campaign met the USAID Programmatic Environmental Assessment selection criteria. The SEA, which was approved on March 15, provides nationwide coverage for the period 2020–2025. EPA Ghana endorsed five classes of insecticides for IRS usage.	No outstanding issues	
1b. Procurement and inventory logs must be maintained.	77,005 units of insecticides were available for 2020, 4,148 of them Actellic® 300 CS and 5,687 SumiShield® 50WG left over from the 2019 campaign. VectorLink Ghana procured an additional 41,730 Fludora® Fusion and 25,440 SumiShield®50WG units. By the end of the campaign, all the Actellic® 300 CS bottles were used up; 483 units of Fludora® Fusion and 20 of SumiShield®50WG remained.	No outstanding issues	The 503 units of insecticide (483 Fludora® Fusion and 20 SumiShield® 50WG) are in stock for the 2021 campaign.
1c. Ensure storage facility and personal protective equipment are appropriate for the active ingredient used and in accordance with approved SOPs.	Central warehouse and site stores were equipped with thermometers, fire extinguishers, spill response kits, wooden pallets, and Material Safety Data Sheets. Stores had adequate ventilation, impermeable floors, secured windows, and doors with double locks. All the storage facilities were guarded 24/7. Before the distribution of insecticides, all the stores were	No outstanding issues	

Mitigation Measure	Status of Mitigation Measures	Outstanding Issues Relating to Required Conditions	Remarks
	supplied with adequate personal protective equipment for SOPs, field supervisors, storekeepers, and other casual workers. A dress rehearsal was conducted at each site to ensure there were no issues of mismatches with the personal protective equipment. Each SOP had at least two pairs of coverall, rubber boots, neck cover, headlamp, (daily) nose mask, and surgical gloves.		
1d. Distribute insecticides to facilities that can manage such commodities safely in storage, use, and disposal (i.e. in a manner generally equivalent to Implementing Partner's own SOPs/Waste Management Plan	Distribution of the insecticides started at the central warehouse and moved to the district stores and further to the operations sites, overseen by the District Logistics Assistant. Distribution was guided by historical records of insecticide consumption by site and followed the "First Expire First Out" rule. All operations site stores were inspected twice before the campaign and found to be appropriate before insecticide distribution was authorized. During the campaign, each store was inspected at least once: any safety gaps were rectified at the time of the inspection. All empty insecticide units were properly stored, documented, labeled, and transported to the central warehouse at the end of the campaign for disposal.		
2a. Inspect and certify vehicles used for insecticide or team transport prior to contract.	Pre-contract inspection of vehicles used for IRS operations was conducted at the regional level on March 20-22, 2020. The selected vehicles were inspected again by the VectorLink ECO before certification on March 23, for compliance with PMI VectorLink project requirements. A total of 56 vehicles were rented to support the 2020 IRS operations.	No outstanding issues	
2b. Train drivers	Due to COVID-19 and the government directive prohibiting gatherings of more than 25 people, the drivers' safety training was organized in three batches of 19, 19, and 18 on March 21-23. All 56 drivers with inspected and certified IRS vehicles received an orientation on safety issues	No outstanding issues	

Mitigation Measure	Status of Mitigation Measures	Outstanding Issues Relating to Required Conditions	Remarks
	including speed limits, a maximum carrying capacity, proper use of personal protective equipment, spill and emergency response procedures, and Abt's policy on motor vehicle use during the IRS campaign. The project sexual harassment guidelines were also incorporated into the drivers' training. Issues related to COVID-19 were highlighted, e.g., social distancing, use of nose masks, hand sanitizers, regular handwashing, and regular vehicle disinfection.		
2c. Ensure availability of cell phone, personal protective equipment and spill kits during insecticide transportation.	All 56 trained drivers provided their cellphone numbers (which were shared with the site managers at each operations site), received adequate personal protective equipment, and spill response kits.	No outstanding issues	
2d. Initial and 30-day pregnancy testing for female candidates for jobs with potential insecticide contact.	All female SOPs, TLs, supervisors, site managers, storekeepers, and washers had pregnancy tests at selected health centers at the district level on March 9-13, 2020. A second round of pregnancy tests was conducted on April 13-17; women who tested positive were reassigned to positions that did not expose them to the insecticide, mostly as mobilizers.	No outstanding issues	
2e. Health test all spray team members for duty fitness.	All SOPs, washers, site managers, and storekeepers were taken through a medical fitness examination at selected health centers at the districts on March 9-13. They were examined for physical fitness, respiratory problems, and allergic reactions to the insecticides.	No outstanding issues	
2f. Procure services of, distribute, and train all workers with potential insecticide contact on the use of personal protective equipment.	Local and international procurement of all required personal protective equipment and IRS commodities was done in good time and distributed to the operations sites a week before the SOPs training. All categories of workers with expected exposure to insecticide received personal protective equipment training either at the TOT or during the cascaded trainings (for SOPs, TLs, washers, storekeepers, etc.).	No outstanding issues	

Mitigation Measure	Status of Mitigation Measures	Outstanding Issues Relating to Required Conditions	Remarks
2g. Train operators on mixing insecticides and the proper use and maintenance of application equipment.	The TOT emphasized sprayer maintenance and correct insecticide mixing procedures. The same session was included in the SOP/TL training with specific demonstration of how to properly clean sprayers using the progressive-rinsing procedure and to ensure thorough cleaning of sprayer parts at the end-of-day clean-up.	No outstanding issues	VectorLink Ghana invited a Goizper technical representative to lead the sprayer maintenance session at the TOT.
2h. Provide adequate facilities and supplies for end-of-day cleanup.	All 26 operations sites had storage facilities that were either provided by District Assemblies or rented from an individual equipped with adequate wash areas and soak pits for end-of-day clean-up. These facilities were inspected during the Pre-spray Environmental Compliance Assessments, and deficiencies were fixed before insecticide distribution to the site was authorized. The project supplied soap, water, and washing containers for all sites.	No outstanding issues	
2i. Enforce application and clean-up procedures.	TLS and site managers were responsible for enforcing end-of-day clean-up procedures. In all, 99 end-of-day clean-up inspections were conducted and only 4 incidents of non-compliance reported.	No outstanding issues	All incidents of non-compliance were corrected immediately.
3a. Implement Information, Education and Communication (IEC) campaigns to inform homeowners of responsibilities and precautions, including washing itchy skin and going to health clinic if symptoms develop and do not subside.	IEC assistants conducted enumeration and mobilization in TSD in December 2019. As part of the IRS trainings, community mobilizers and SOPs were trained to inform homeowners about their roles and responsibilities before, during, and after spray protocols for household safety. Households were sensitized to wash itchy skin with plenty of water and soap and, if itching persisted, to contact the nearest clinics. Out of 7,042 inspections of homeowner preparation, only three beneficiaries claimed that they were not informed of potential reactions to insecticide exposure. There were no reports of failure to inform a homeowner on referral to a clinic in case of exposure.	No outstanding issues	
3b. Ensure health facility staff are aware of insecticide poisoning management.	Staff from partnering health facilities across all 26 operations sites received orientation on insecticide	No outstanding issues	

Mitigation Measure	Status of Mitigation Measures	Outstanding Issues Relating to Required Conditions	Remarks
	selected for 2020 IRS. Material Safety Data Sheets were shared with the health workers after the orientation to assist with managing possible exposures.		
4a. Storage facilities and transportation vehicles must be physically secured to prevent theft.	All storage facilities had secured doors with double locks, and windows with bars and screens. All vehicles (pick-ups/buses) had secured a boot/bucket with a tarpaulin to ensure the safety of the insecticide during transport and to prevent theft.	No outstanding issues	
4b. Maintain records of all insecticide receipts, issuance, and return of empty containers.	All insecticide issued was based on a request with appropriate approvals and accompanied by delivery notes. All insecticides received at operations sites were recorded in the store ledger, and on individual stock cards for each item including both full and empty bottles/sachets. Additionally, all bottles/sachets issued to the field were barcoded, scanned, and recorded in the insecticide tracking sheets and a cloud-based database. Out 296 completed store inspections, only 24 reported non-compliance related to records maintenance. Incidents were investigated and guidance and corrective measures provided on the spot.	No outstanding issues	
4c. Conduct analysis comparing number of houses treated vs. number of containers used.	The project treated 339,139 structures with 76,502 units of insecticide. The ratio is 4.43 structures per a unit of insecticide, which is comparable to the 2019 ratio of 4.47. VectorLink Ghana monitored the usage ratio on a weekly basis to ensure the consumption was in line with the plan.		
4d. Examine houses treated to confirm application.	During the campaign, VectorLink Ghana completed 16,288 DOS inspections and carried out numerous spot checks. Wall cone bioassays conducted 2 days after spraying established that the walls received high-quality insecticide application based on the results of 100% mosquito mortality.		
4e. Perform physical inventory counts during the application season.	Supervisors carried out 296 storekeeper performance inspections in all 26 stores. Of the 296 inspections,	No outstanding issues	

Mitigation Measure	Status of Mitigation Measures	Outstanding Issues Relating to Required Conditions	Remarks
	only two incidents were observed, where the balance on the stock card did not equal the result of a physical stock inventory counts Investigations were carried out immediately to rectify the error.		
5a. For shipments of insecticide over water, sachets/ bottles will be packed in 220 liter open top barrels with a water-tight top and a locking ring, or in a similar durable container. Waterproof labeling must be affixed to the barrel, with the identity of the pesticide, number of bottles inside, the weight, the type of hazard posed by the contents, and the personal protective equipment to be worn when handling the barrel.	No insecticides were transported across water. All insecticides were transported by road from the central warehouse to the site stores.	No outstanding issues	
5b. Train applicators on the SEA operational requirements, SOPs, PMI BMPs, and approved Waste Management Plan, developed for the safe and effective storage, distribution, application, and disposal of insecticides.	The VectorLink project team trained all cadres of IRS actors on how to handle insecticide in storage and in the field, how each type of waste is generated during the campaign, and where each is to be stored, managed, and disposed of in accordance with the Safer Use Action Plan and the revised PMI BMP manual.	No outstanding issues	
5c. Ensure application equipment and personal protective equipment are appropriate for the active ingredient used and in accordance with approved SOPs, and maintain equipment to avoid leaks.	Adequate spare parts were made available at all operations sites. Sprayer servicing and calibrations were conducted weekly to ensure the right dosage of the active ingredient was applied. Personal protective equipment use was enforced throughout the campaign. Out of 7,042 homeowner preparation and spray operator performance inspections, only one observation reported an SOP not using personal protective equipment appropriately and corrective guidance was delivered on the spot. Pump leakage was reported in only 102 instances. These were resolved promptly.	No outstanding issues	

Mitigation Measure	Status of Mitigation Measures	Outstanding Issues Relating to Required Conditions	Remarks
5d. Maintain application equipment.	Site managers and supervisors carried out weekly calibration and oiling of the sprayers, replacing worn-out nozzles and nozzle sieves.	No outstanding issues	
5e. No application of insecticides within 30 yards of beekeeping sites.	There are no known beekeeping sites across the IRS districts in Ghana. However, TOTs and SOP trainings emphasized keeping any beehives at least 30 meters away from spray areas.	No outstanding issues	
6a. Handling, treatment, and disposal of nonhazardous (general waste) and hazardous wastes must be in accordance with the approved Waste Management Plan /SOPs and the PMI BMPs. The WMP, which outlines SOPs for managing waste processes, must be in accordance with PMI best practices and host country requirements	Non-hazardous wastes were recorded and stored away from contaminated wastes. Non-contaminated cardboard from the insecticides will be recycled alongside other paper products at Fine Print Ltd in Tema in late July. All hazardous wastes were recorded, labeled, and kept in the stores while awaiting disposal either by incineration by Zoil and/or recycling by Cyclus Ltd. Uncontaminated coveralls and boots not appropriate for IRS will be donated to hard-working and deserving SOPs.	No outstanding issues	
6b. Choose sites for disposal of liquid wastes, including fixed and mobile soak pit sites according to PMI BMPs	Locations for all 29 fixed soak pits and 8 MSPs were selected jointly with the EPA and DEHOs, with consideration for liquid waste disposal that accumulated from washing of personal protective equipment as prescribed in the revised PMI BMP guidelines.	No outstanding issues	
6c. Construct fixed and mobile soak pits with charcoal according to the BMPs to adsorb insecticide from rinse water.	Two new fixed soak pits and one mobile soak pit were constructed in TSD with the appropriate charcoal stacked as prescribed in the revised PMI BMP guidelines. Eight other fixed soak pits were desilted and refilled, also as prescribed in the BMP.	No outstanding issues	Recommended to convert the mobile soak pit site at Kunkwa (MMD) to a permanent fixed soak pit site because of the distance to transport coveralls to Yizesi for washing.
6d. Maintain soak pits as necessary during season.	All soak pits were in good shape and absorbed waste water without puddling during the campaign. Results from the End-of-Day Clean-Up form on soak pit performance were reported.	No outstanding issues	Future soak pit rehabilitation will follow the directive that says all soak pits will be blocked from receiving water from the wash area during the off-season.

Mitigation Measure	Status of Mitigation Measures	Outstanding Issues Relating to Required Conditions	Remarks
6e. Monitor waste storage and management during campaign.	All solid wastes were recorded, properly labelled, and moved from the site offices to district offices for final inventory and then to the central warehouse for disposal. Of 296 inspections carried out, there was only one report of contaminated items not separated from non-contaminated waste. Guidance was provided on the spot to fix the error.	No outstanding issues	
6f. Monitor disposal procedures post-campaign	The ECO and EPA representative will monitor the disposal and ensure adherence of personal protective equipment usage during the disposal.	No outstanding issues	
7a. Wastes will only be disposed in incinerators that comply with PMI BMPs Collect and maintain treatment and disposal documents and records on file.	All solid wastes for recycling will be sent to Cyclus Ltd, and all for incineration will be sent to Zoil and/or KATH. These facilities meet specifications of the PMI BMP guidelines.	No outstanding issues	
7b. Country-level USAID EC documentation must contain guidance on proper disposal of wastes	Both liquid and solid waste disposal procedures were aligned with the Safer Use Action Plan and in accordance with the revised PMI BMP guidelines.	No outstanding issues	

ANNEX D. 2020 PMI VECTORLINK GHANA INDICATOR MATRIX

#	Performance Indicator	Global Project Indicator	Data Source(s) and Reporting Frequency	Disaggregation(s)	Annual Targets and Results									
					Year 1 2018		Year 2 2019		Year 3 2020		Year 4 2021		Year 5 2022	
					Target	Result	Target	Result	Target	Result	Target	Result	Target	Result
Objective 1: Implementation of Malaria Vector Control (VC) Interventions														
1.1	Successfully Execute IRS and Other Integrated Malaria VC Activities													
1.1.1	Number and percentage of completed annual country work plans developed and submitted on-time	X	Project records Annually	Country										
1.1.2	Number of eligible structures		Project records	Country	324,115 ⁶	324,704 ⁷	324,704 ⁸	316,285 ⁹	346,285 ¹⁰	366,283				

⁶ Based on structures found during 2017 AIRS spray campaign

⁷ Based of structures found by SOPs in 2018

⁸ The initial target of 351,507 was revised to 324,704 because Cheraponi district's target of 26,803 was taken out. 324,507 was the number of structures found in 2018.

⁹ The number was adjusted to remove 1,104 ineligible structures identified as 'will be locked for more than 6 months.'

¹⁰ This target is the total of 316,285 eligible structures found by SOPs in 2019 and 30,000 structures estimated for Tatala-Sanguli District (TSD), a new IRS district.

#	Performance Indicator	Global Project Indicator	Data Source(s) and Reporting Frequency	Disaggregation(s)	Annual Targets and Results									
					Year 1 2018		Year 2 2019		Year 3 2020		Year 4 2021		Year 5 2022	
					Target	Result	Target	Result	Target	Result	Target	Result	Target	Result
	targeted for spraying		Annually											
1.1.3	Number of eligible structures sprayed with IRS ¹¹		Project records Annually	Country	275,498 ¹²	298,701	275,998 (85%)	298,385	294,342 (85% PMI)	339,139				
							292,234 (90%) ¹³		311,657 (90% NMCP)					
1.1.4	Percentage of total structures targeted for spraying that were sprayed with a residual insecticide (Spray Coverage)		Project records Annually	Country	85% (PMI) 90% (NMCP)	92.0%	85% (PMI) 90% (NMCP)	94.3%	85% (PMI) 90% (NMCP)	92.6%				
1.1.5	Number of people protected by IRS		Project records Annually	Country Sex Pregnant women Children <5	874,608 ¹⁴	836,376 18,397 pregnant women	882,572 ¹⁵	875,481 19,844 pregnant women,	990,579 ¹⁶	965,467 21,295 pregnant women				

11 Target based on 85% of estimated eligible structures in Indicator 1.1.2.

12 Based on 85% of 1.1.2 target for 2018

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

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 VectorLink spray campaign.

16 Population targeted consists of 913,781 found by SOPs in the 2019 spray campaign and 76,798 estimated for TSD.

#	Performance Indicator	Global Project Indicator	Data Source(s) and Reporting Frequency	Disaggregation(s)	Annual Targets and Results									
					Year 1 2018		Year 2 2019		Year 3 2020		Year 4 2021		Year 5 2022	
					Target	Result	Target	Result	Target	Result	Target	Result	Target	Result
						148,627 children <5		157,398 children <5		161,750 children <5				
1.1.6	Number and percentage of vector control project country programs submitting an EOSR within 45 days after the end of spray (including completing MEP and EMMR)	X	Project Annually	Country										
1.1.7	Number and percentage of IRS country programs that conduct a Post-Spray Data Quality Audit within 90 days of spray completion	X	Data Collection Forms Annually	Country										
1.1.8	Number of Insecticide Treated Nets (ITNs) distributed, by channel		Project Records Annually	Country Channel	N/A	N/A	N/A	N/A	N/A	N/A				

#	Performance Indicator	Global Project Indicator	Data Source(s) and Reporting Frequency	Disaggregation(s)	Annual Targets and Results									
					Year 1 2018		Year 2 2019		Year 3 2020		Year 4 2021		Year 5 2022	
					Target	Result	Target	Result	Target	Result	Target	Result	Target	Result
1.1.9	Number and percentage of countries completing ITN durability monitoring data collection as planned in a given project year	X	Project Records Annually	Country										
1.1.10	Number and percentage of PMI-funded durability monitoring surveys with reports submitted within 90 days of the end of data collection	X	Project Records Annually	Country										
1.2	Strengthen Capacity of NMCPs, VC Personnel, and Other Institutions to Implement and Manage IRS and Other VC Activities													
1.2.1	Total number of people trained to		Project Training Records	Country VC Intervention	2,392	2,360 IRS	3,084	2,289 IRS	2,850 ¹⁷	2,716 ¹⁸ IRS				

17 Composed of Disease Control Officers (DCOs) 9, DEHOs 9, EPA reps 2, District Health Information Officers (DHIOs) 9, DHPOs 9, District Supply Officers (DSOs) 9, SOPs 676, TLs 139, DEAs 47, M&E Assistants 20, Logistics Assistants 8, Store Assistants 30, IEC Assistants 27, Field Supervisors 56, Site Managers 27, Finance Assistants 8, Mobilizers 1560, CHNs 205. These figures include buffer.

18 DCOs 9, DEHOs 9, EPA, 1, DHIOs 9, DHPOs 9, DSOs 6, NMCP 1, CHNs 158, IEC Assistants 27, Finance Assistants 8, Mobilizers 1,507, Field Supervisors 62,

#	Performance Indicator	Global Project Indicator	Data Source(s) and Reporting Frequency	Disaggregation(s)	Annual Targets and Results									
					Year 1 2018		Year 2 2019		Year 3 2020		Year 4 2021		Year 5 2022	
					Target	Result	Target	Result	Target	Result	Target	Result	Target	Result
	support VC in target areas		Annually	Sex Job Function		2,027 (85.9%) male 333 (14.1%) female		1,887 (82.4%) male 402 (17.6%) female		2,193 (80.7%) male, 523 (19.3%) female				
1.2.2	Total number of people trained to support VC in target areas with USG funds ¹⁹		Project Training Records Annually	Country VC Intervention Sex Job Function	856 ²⁰	837 ²¹ IRS 677 (80.9%) male, 160 (19.1%) female	925 ²²	864 ²³ IRS 676 (78.2%), male 188 (21.8 %) female	871 ²⁴	843 ²⁵ IRS 603 (71.5%) male, 240 (28.5%) female				
1.2.3	Number of people trained during the Master (National) Training and/or IRS		Project Training Records Annually	Country Sex Type of Training	106	103; 96 (93.2%) male 7 (6.8%) females	103	103; 88 (85.4%) male 15 (14.6%) female	103 ²⁶	113 92 (81.4) male, 21 (18.6%) female				

SOPs 654, TLs 127, M&E Assistants 17, DEAs 45, Logistics Assistants 8, Stores Assistants 28 and Site Managers 31

19 For IRS programs, this includes SOPs, TLs, and Field Supervisors.

20 SOPs (660), TLs (132), Field Supervisors (64)

21 SOPs (644), TLs (127), Field Supervisors (66)

22SOPs (725), TLs (145), Field Supervisors (55)

23 SOPs (667), TLs (140), Field Supervisors (57)

24 SOPs 676, TLs 139, and Field Supervisors 56

25 SOPs 654, TLs 127 and Field Supervisors 62

26 DCO 9, DEHO 9, EPA rep 2, Field Supervisors 56, and Site Managers 27

#	Performance Indicator	Global Project Indicator	Data Source(s) and Reporting Frequency	Disaggregation(s)	Annual Targets and Results									
					Year 1 2018		Year 2 2019		Year 3 2020		Year 4 2021		Year 5 2022	
					Target	Result	Target	Result	Target	Result	Target	Result	Target	Result
	Training of Trainers.													
1.2.4	Total number of people hired to support VC in target areas.		Project Records Annually	Country VC Intervention Sex Job Function	2,248 ²⁷	2,447 ²⁸ IRS 2,067 (84.5%) males 380 (15.5%) females	2,865 ²⁹	2,594 ³⁰ IRS 2,125 (81.9%), male 469 (18.1%) female	2,633 ³¹	2,636 ³² IRS 2,085 79.1% male 551 (20.9%) female				
1.2.5	Number of VC project training workshops targeting NMCP and		Project Training Records	Country Technical Area Job Function	1 ³³	1	1	1 ³⁴	1 ³⁵	1				

27 Refer to Indicator 1.4.1 less Government staff (83), Buffer (45), Drivers (48), and Security Guards (45)

28 DOCs (3), DEAs (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), TLs (121), Washers (57), Water Fetchers (20), M&E Assistants (11), Packers (140), Entomology Assistants (136)

29 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)]

30 DOC (1), DEAs (34), Finance Assistants (8), M&E Assistants (15), IEC Assistants (26), Logistic Assistants (8), Stores Assistants (25), Mobilizers (1169), Security Guards (50), Site Managers (24), SOPs (637), Field Supervisors (50), TLs (126), Washers (66), Water Fetchers (11), Packers (200). Entomology Assistants (144)

31 SOPs 644, TLs 127, DEAs 37, M&E Assistants 12, Logistics Assistants 8, Stores Assistants 28, IEC Assistants 27, IEC Mobilizers 1,486, Field Supervisors 50, Security Guards 55, Site Managers 27, Finance Assistants 8, Washers 70, and Water Fetchers 54

32 SOPs 643, TLs 130, DEAs 37, M&E Assistants 12, Logistics Assistants 9, Stores Assistants 28, Mobilizers 1,371, Field Supervisors 50, Site Managers 26, Finance Assistant 8, Washers 67, Water Fetchers 17, Security Guards 55, Packers 156, IEC Assistants 27

33 TOT

34 Boot camp for IRS technical training for GHS, VectorLink staff, AngloGold Ashanti Malaria Control (AGAMaL), and NMCP in Tamale

35 IRS Operations TOT

#	Performance Indicator	Global Project Indicator	Data Source(s) and Reporting Frequency	Disaggregation(s)	Annual Targets and Results									
					Year 1 2018		Year 2 2019		Year 3 2020		Year 4 2021		Year 5 2022	
					Target	Result	Target	Result	Target	Result	Target	Result	Target	Result
	other host country staff		Annually											
1.2.6	Number of NMCP and other vector control host country staff who have logged into VectorLink Collect		DHIS2 Logs Annually	Country Job Function	N/A	N/A	N/A	N/A	0	0				
1.2.7	Number and percentage of technical assistance requests to support ITN distribution planning and/or implementation completed on time as planned in a given project year	X	Project Records Annually	Country Technical Area Channel										
1.2.8	Number and percentage of technical assistance requests to support	X	Project Records Annually	Country Channel										

#	Performance Indicator	Global Project Indicator	Data Source(s) and Reporting Frequency	Disaggregation(s)	Annual Targets and Results									
					Year 1 2018		Year 2 2019		Year 3 2020		Year 4 2021		Year 5 2022	
					Target	Result	Target	Result	Target	Result	Target	Result	Target	Result
	operational routine monitoring systems for continuous ITN distribution completed on time as planned in a given project year													
1.3	Environmental Compliance and Safety													
1.3.1	Number of seasonal vector control personnel trained in environmental compliance and personal safety standards in vector control implementation		Project Training Records Annually	Country Sex (# and %) Job Function	893 ³⁶	874 ³⁷ 713 (81.6%) male, 161 (18.4%) female	973 ³⁸	910 712 (78.2%) male 198 (21.8%) female	990 ³⁹	964 686 (71.2%) male 278 (28.8%) female				

36 SOPs (660), TLs (132), Field Supervisors (64), Site Managers (21) DCOs & DEHOs (14), EPA Rep (2)

37 SOPs (644), TLs (127), Field Supervisors (66), Site Managers (21), DOCs (3), DCOs (7), DEHOs (5), EPA Rep (1)

38 TOT: One DOC (CHD), DCOs (9), DEHOs (9), Regional Malaria Focal Person (2), Field Supervisors (55), Site Managers (25), EPA and NMCP (2) and Spray Operations Training: SOPs, TLs (870)

39 SOPs (676), TLs (139), Field Supervisors 56, Site Managers (27), District DCOs (9), DEHOs (9), DHPOs (9), Logistics Assistants (8), Store Assistants (30), and IEC Assistants (27)

#	Performance Indicator	Global Project Indicator	Data Source(s) and Reporting Frequency	Disaggregation(s)	Annual Targets and Results									
					Year 1 2018		Year 2 2019		Year 3 2020		Year 4 2021		Year 5 2022	
					Target	Result	Target	Result	Target	Result	Target	Result	Target	Result
1.3.2	Number of health workers receiving insecticide poisoning case management training		Project Training Records Annually	Country Sex (# and %)	42	41 33 males (80.5%); 8 females (19.5%)	0	0	0 ⁴⁰	0				
1.3.3	Number of adverse reactions to pesticide exposure documented that resulted in a referral for medical care		Incident Report Forms Annually	Country Type of Exposure	0	0	0	0	0	0				
1.3.4	Number of SEAs and Letter Reports submitted at least 60 days prior to the commencement of VC campaigns	X	Project Records Annually	Country	1	1	1	1	1	1				
1.3.5	Number and percentage of permanent and		Project Records - PSECAs	Country	39; 100%	39; 100% PSP: 22	41; 100% PSP: 28	51; 107% PSP: 27	49; 100%	45; 100% PSP/FSP 29				

40 Since Year 2, the project has conducted orientation discussions, not trainings for health personnel.

#	Performance Indicator	Global Project Indicator	Data Source(s) and Reporting Frequency	Disaggregation(s)	Annual Targets and Results									
					Year 1 2018		Year 2 2019		Year 3 2020		Year 4 2021		Year 5 2022	
					Target	Result	Target	Result	Target	Result	Target	Result	Target	Result
	mobile soak pits inspected and approved prior to IRS campaigns or before first use		Annually		PSP: 2241 MSP: 17 ⁴²	MSP: 17	MSP: 13	MSP: 17	PSP 30;100% MSP 19	MSP 16				
1.3.6	Number and percentage of storehouses inspected and approved prior to IRS campaigns		Project Records PSECAs Annually	Country Storehouse Type	22 ⁴³ ; 100%	22; 100%	26 ⁴⁴ ; 100%	26; 100%	27; 100%	32; 100%				
1.4	Promote Gender Equality in all Facets of Planning and Implementation													
1.4.1	Number and percentage of women hired to support VC campaigns		Project Records Annually	Country Sex (# and %) Job Function	450; 20%	380; 15.5% ⁴⁵	562; 20%	469 ⁴⁶ ; 18.1%	789 ⁴⁷ ; 30%	551; 20.9%				

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

42 BYD (1), EMD (4), WMD (3), MMD (1), KAD (Singa camping site; 5), GUD (1), and KAD (2)

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

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

45 % of Indicator 1.2.4.

46 Refer to Indicator 1.2.4

47 30% of Indicator 1.2.4

#	Performance Indicator	Global Project Indicator	Data Source(s) and Reporting Frequency	Disaggregation(s)	Annual Targets and Results									
					Year 1 2018		Year 2 2019		Year 3 2020		Year 4 2021		Year 5 2022	
					Target	Result	Target	Result	Target	Result	Target	Result	Target	Result
1.4.2	Number and percentage of women hired in supervisory roles in target areas for VC activities		Project Records Annually	Country Sex (# and %) VC Intervention Job Function	51 ⁴⁸ ; 16%	36; 14.2%	54; 20%	54 ⁴⁹ ; 21.0%	75 ⁵⁰ ; 30%	61 ⁵¹ ; 24.0%				
1.4.3	Number and percentage of trainees (permanent and seasonal) who have completed gender awareness training		Project Records Annually	Country Sex (# and %) Job Function	864 ⁵² ; 100%	874 ⁵³ ; 100% 713 (81.6%) males 161 (18.4%) females	993 ⁵⁴ ; 100%	910 ⁵⁵ ; 91.6% 712 (78.2%) males 198 (21.8%) females,	2,718 ⁵⁶ ; 100%	2,716 ⁵⁷ ; 100% 2,193 (80.7%) males 523 (19.3%) females				
1.4.4	Number and percentage of women in	X	Project Records	Country										

48 DOC (1), M&E Assistant (1), IEC Assistants (2), TLs (25), Field Supervisors (5), Logistics Assistant (2); total Supervisors hired (254).

49 DOC (1), M&E and DCV Assistants (2), IEC Assistants (5), TLs (33), Logistics Assistant (1), Field Supervisor (5), Site Manager (7).

50 30% of 251 people hired in supervisory roles: Site Managers 27, Field Supervisors 50, TLs 127, M&E Assistants 12, Logistics Assistants 8, and IEC Assistants 27

51 TL 37, Field Supervisors 7, Site Managers 11, M&E Assistant 0, Log Assistant 1 and IEC Assistants 5

52 For TOT, TL, and SOP trainings

53 DOCs (3), DCOs (7), DEHOs (5), EPA Rep. (1), Field Supervisors (66), Site Managers (21), TLs (127), and SOPs (644)

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

55 DOC (1), DCOs (9), DEHOs (9), Field Supervisors (57), Site Managers (27), SOPs (667), TLs (140)

56 Total number of people to train 2,703 plus 15 of project full-time staff

57 Total number of people trained.

#	Performance Indicator	Global Project Indicator	Data Source(s) and Reporting Frequency	Disaggregation(s)	Annual Targets and Results											
					Year 1 2018		Year 2 2019		Year 3 2020		Year 4 2021		Year 5 2022			
					Target	Result	Target	Result	Target	Result	Target	Result	Target	Result		
	senior leadership roles in VectorLink country offices		Annually	Sex (# and %)												
1.5	Implement and Support SBCC and Mobilization Activities															
1.5.1	Number of radio spots and talk shows aired		Project Records Annually	Country VC Intervention Talk Show or Radio Spot	900	1,284 IRS 840 radio spots 24 talk shows	1,086 IRS 630 spots 36 talk shows	1,446 IRS 990 spots 36 talk shows 420 radio messages	1,059 IRS 35 Radio discussions 142 Radio messages 882 Radio Spots	1,746 IRS 988 Radio Spots 30 talk shows 728 Announcements						
1.5.2	Number of print materials distributed to or targeted at beneficiaries		Project Records Annually	Country VC Intervention	4,000	8,000 IRS	18,400 ⁵⁸ IRS	12,382 IRS	13,000 ⁵⁹ IRS	8,892 IRS						

58 The print materials are disaggregated as follows: 5,000 malaria-free posters and spray calendars, 5000 IRS steps posters, 8,400 brochures

59 8,000 community spray calendars and 5,000 malaria-free posters

#	Performance Indicator	Global Project Indicator	Data Source(s) and Reporting Frequency	Disaggregation(s)	Annual Targets and Results									
					Year 1 2018		Year 2 2019		Year 3 2020		Year 4 2021		Year 5 2022	
					Target	Result	Target	Result	Target	Result	Target	Result	Target	Result
1.5.3	Number of people reached with vector control and/or SBCC messages via door-to-door messaging		Project Records Annually	Country VC Intervention Sex	437,304 ⁶⁰ IRS	274,055 IRS 121,672 males (44.4%) 152,383 females (55.6%)	48,791 ⁶¹ IRS	32,476 ⁶² IRS 15,170 male (46.7%), 17,306 female (53.3%)	11,316 ⁶³ IRS	33,454 ⁶⁴ IRS 15,063 males, 18,391 female				
2. Entomological and Epidemiological Data to Drive Decision-Making														
2.1	Vector Control Activities Monitored via Entomological and Epidemiological Data													
2.1.1	Number of project-supported entomological sentinel sites established to monitor vector bionomics		Entomological Reports Annually	Country VC Intervention	20	20 IRS	16 ⁶⁵	16 IRS	12 ⁶⁶	12 IRS				

60 Targeting 50% of population found (ref Indicator 1.1.5) in 2017

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

62 This includes 24,658 persons (11,416 males and 13,242 females) in CHD and 7,818 (3,754 male and 4,064 female) in hard-to-reach communities in the rest of the districts.

63 An estimated population expected for door-to-door messaging in TSD when enumerating the households (7,500) and 50% of population found in locked and refused households in 2019 (3,816).

64 House-to-house mobilization in TSD 25,383 and other eight districts 8,071

65 Revised number of sentinel sites is 16 for 2019.

66 8 sites in the Northern and North East Regions and 4 sites to be in support of the NMCP.

#	Performance Indicator	Global Project Indicator	Data Source(s) and Reporting Frequency	Disaggregation(s)	Annual Targets and Results									
					Year 1 2018		Year 2 2019		Year 3 2020		Year 4 2021		Year 5 2022	
					Target	Result	Target	Result	Target	Result	Target	Result	Target	Result
	(vector species, distribution, seasonality, feeding time, and location)													
2.1.2	Number and percentage of vector bionomics monitoring sites measuring all basic entomological indicators (species composition, indoor and outdoor human biting rates, hourly human biting rates, indoor resting densities)		Entomological Reports Annually	Country VC Intervention	7 ⁶⁷ ; 35%	7, 35%	4 ⁶⁸ , 25%	4, 25%	12; 100%	12; 100%				
						IRS		IRS		IRS				
2.1.3	Number and percentage of vector bionomics monitoring sites measuring		Entomological Reports Annually	Country	20; 100%	20; 100%	16; 100%	16; 100%	12; 100%	12:100%				
						IRS		IRS		IRS				

67 For IRS only; 7 out of the total 20 sites will measure all 5 basic PMI entomological indicators.

68 For IRS only; 4 out of the total 16 sites will measure all 5 basic PMI entomological indicators.

#	Performance Indicator	Global Project Indicator	Data Source(s) and Reporting Frequency	Disaggregation(s)	Annual Targets and Results															
					Year 1 2018		Year 2 2019		Year 3 2020		Year 4 2021		Year 5 2022							
					Target	Result	Target	Result	Target	Result	Target	Result	Target	Result						
	the following all advanced entomological indicators: sporozoite rates and entomological inoculation rates			IRS or Entomology Only Program																
2.1.4	Number and percentage of insecticide resistance monitoring sites that tested all priority insecticides for the relevant local vector control intervention		Entomological Reports Annually	Country VC Intervention	0 IRS	0 IRS	0 IRS	0 IRS	17; 100% IRS	TBD										
2.1.5	Number and percentage of houses in which WHO cone bioassays were conducted within two weeks of spraying with		Entomological Reports Annually	Country Insecticide Type	56, 100% Actellic®300CS: 48, 100% SumiShield®50WG: 8, 100%	72 ⁶⁹ , 100% Actellic®300CS: 64, 100% SumiShield®50WG: 8, 100%	56, 100% Actellic®300CS: 24, 100% SumiShield®50WG: 32, 100%	56, 100% Actellic®300CS: 24, 100% SumiShield®50WG: 32, 100%	36, 100% 4, 100% 16, 100% 16, 100%	36, 100% Actellic®300CS: 4, 100% Fludora® Fusion: 16, 100%										

69 Completed between April and June

#	Performance Indicator	Global Project Indicator	Data Source(s) and Reporting Frequency	Disaggregation(s)	Annual Targets and Results									
					Year 1 2018		Year 2 2019		Year 3 2020		Year 4 2021		Year 5 2022	
					Target	Result	Target	Result	Target	Result	Target	Result	Target	Result
	greater than 98% test mortality recorded for IRS countries									SumiShield® 50WG: 16, 100%				
2.1.6	Number and percentage of sites that conducted WHO cone bioassays after the completion of spraying at monthly intervals until test mortality drops below 80% for two consecutive months for IRS countries		Entomological Reports Annually	Country Insecticide Type	7;100% Actellic®300CS: 6, 100% SumiShield® 50WG:1, 100%	7;100% Actellic®300CS: 6, 100% SumiShield® 50WG:1, 100%	7;100% Actellic®300CS: 4, 100% SumiShield® 50WG: 3, 100%	7;100% Actellic®300CS: 4, 100% SumiShield® 50WG: 3, 100%	6; 100% Actellic®300CS: 2, 100% Fludora® Fusion: 2, 100% SumiShield® 50WG2, 100%	TBD Activities suspended because of COVID 19. Indicator will be updated by the end of the year				
2.1.7	Number of countries with an integrated vector control analytics dashboard created by PATH, available for decision-making	X	Project Reports Annually	Country										

#	Performance Indicator	Global Project Indicator	Data Source(s) and Reporting Frequency	Disaggregation(s)	Annual Targets and Results									
					Year 1 2018		Year 2 2019		Year 3 2020		Year 4 2021		Year 5 2022	
					Target	Result	Target	Result	Target	Result	Target	Result	Target	Result
2.1.8	Number of people trained (VectorLink and non VectorLink staff) in entomological monitoring		Project Records Annually	Country Sex (# and %)	80 ⁷⁰	74 ⁷¹ 71 males (95.9%) 3 females (4.1%)	20 ⁷²	36 ⁷³ 33 males (91.7%) 3 females (8.3%)	0	0				
2.1.9	Number and percentage of sites in which WHO cone bioassays were conducted to evaluate bio-efficacy of bed nets		Entomological Records Annually	Country	NA	NA	2	2, 100%	2, 100%	TBD ⁷⁴				
2.1.10	Number of nets in which WHO cone bioassays were		Entomological Records	Country	NA	NA	NA	60	60	TBD ⁷⁵				

⁷⁰ Non-project staff

⁷¹ Entomology data collectors (74)

⁷² Mosquito collectors to be trained in new sentinel sites in CHD.

⁷³ Project trained 20 people in CHD (although IRS was not done there due to ethnic unrest) and 16 people in TSD, to start baseline data collection in 2019. The 3 females consist of 1 supervisor for CHD, and 1 supervisor and 1 collector for TSD.

⁷⁴ This is part of durability monitoring, which will be carried out in July-August. Same for Indicator 2.1.10.

⁷⁵ ibid

#	Performance Indicator	Global Project Indicator	Data Source(s) and Reporting Frequency	Disaggregation(s)	Annual Targets and Results									
					Year 1 2018		Year 2 2019		Year 3 2020		Year 4 2021		Year 5 2022	
					Target	Result	Target	Result	Target	Result	Target	Result	Target	Result
	conducted to evaluate bio-efficacy of bed nets		Annually											
2.2	NMCPs Develop Country-Level IRS and Other Malaria VC Strategies													
2.2.1	Number and percentage of countries with an integrated malaria vector control strategy, including a plan for monitoring and managing insecticide resistance supported by the project	X	Project Records Annually	Country										
2.2.2	Number and percentage of countries with a data and visualization dashboard complete for IRS and/or entomology data in VectorLink Collect for	X	Project Records Annually	Country										

#	Performance Indicator	Global Project Indicator	Data Source(s) and Reporting Frequency	Disaggregation(s)	Annual Targets and Results									
					Year 1 2018		Year 2 2019		Year 3 2020		Year 4 2021		Year 5 2022	
					Target	Result	Target	Result	Target	Result	Target	Result	Target	Result
	vector control decision making													
2.2.3	Number of countries that implement sub-national insecticide rotation	X	Project Records Annually	Country										
2.3	Build capacity of NMCPs and local institutions to collect, analyze, and use data for strategic malaria control decision-making													
2.3.1	Number of individuals trained from NMCPs and national institutions to review and interpret data for integrated vector control decision making		Project Training Records Annually	Country Job Function Organization	N/A	N/A	N/A	N/A	N/A	N/A				
2.3.2	Number and percent of targeted individuals that report using new analytical tools and/or skills in their		Capacity Assessments Thrice Over Project Life	Country Job Function Organization	N/A	N/A	N/A	N/A	N/A	N/A				

#	Performance Indicator	Global Project Indicator	Data Source(s) and Reporting Frequency	Disaggregation(s)	Annual Targets and Results									
					Year 1 2018		Year 2 2019		Year 3 2020		Year 4 2021		Year 5 2022	
					Target	Result	Target	Result	Target	Result	Target	Result	Target	Result
	planning, resourcing, implementation, or measurement activities													
3. Procurement and Logistics														
3.1 Cost-Effective Procurement Mechanism Established														
3.1.1	Number and percentage of insecticide procurements that had a pre-shipment QA/QC test, done by a third party, at least 60 days prior to spray campaign	X	Procurement Records Annually	Country Insecticide Type										
3.1.2	Number and percentage of insecticide		Procurement Records	Country	3 ⁷⁶ ; 100%	1 ⁷⁷ ; 33.3%	2 ⁷⁹ ; 100%	2; 100%	2 ⁸⁰ ; 100%	2 ⁸¹ ; 100%				

76 1 procurement (Actellic®300CS) arriving in two shipments; 1 donation (i.e., not procured by VectorLink Ghana) of SumiShield® 50WG

77 1 shipment of Actellic® 300CS arrived on time to allow for the initiation of VectorLink campaign. 2nd shipment of Actellic® 300CS and SumiShield® 50WG arrived during the campaign.

79 1 for SumiShield® 50WG and 1 for Actellic® 300CS

80 SumiShield® 50WG (for BND, KAD, WMD, and YND), and Fludora® Fusion (for EMD, GUD, KUD, and TSD)

81 Fludora® Fusion and SumiShield® 50WG

#	Performance Indicator	Global Project Indicator	Data Source(s) and Reporting Frequency	Disaggregation(s)	Annual Targets and Results									
					Year 1 2018		Year 2 2019		Year 3 2020		Year 4 2021		Year 5 2022	
					Target	Result	Target	Result	Target	Result	Target	Result	Target	Result
	procurements received on-time to allow for the initiation of spray operations as scheduled		Annually	Insecticide Type		Actellic®300CS (1:33.33%) ⁷⁸		SumiShield® 50WG (1:100%) Actellic® 300CS (100%)		Fludora® Fusion (1:100%) SumiShield® 50WG (1:100%)				
3.1.3	Number and percentage of targeted countries with international equipment procurements, including PPE, received on-time to allow for the initiation of vector control campaigns as scheduled	X	Procurement Records Annually	Country VC Intervention										
3.1.4	Number of VectorLink staff trained on procurement	X	Project Records Annually	Country										

⁷⁸ In 2018, VectorLink Ghana has 3 shipments. 1 shipment arrived on time before the start of the IRS campaign.

#	Performance Indicator	Global Project Indicator	Data Source(s) and Reporting Frequency	Disaggregation(s)	Annual Targets and Results									
					Year 1 2018		Year 2 2019		Year 3 2020		Year 4 2021		Year 5 2022	
					Target	Result	Target	Result	Target	Result	Target	Result	Target	Result
3.2	Robust Inventory Management and Logistics Systems Established													
3.2.1	Number and percentage of logistics and warehouse personnel (seasonal and full-time) trained in VC supply chain management		Project Training Records Annually	Country VC Intervention Sex Job Function	31 ⁸² ; 100%	31 ⁷⁵ ; 100% IRS 12 (38.7%) males 19 (61.3%) females	36; 100%	36 ⁸³ ;100% IRS 12 (33.3%) males 24 (66.7%) females	36 ⁸⁴ ;100%	36; 100% IRS 15 (41.7%) males 21 (58.3%) females				
3.2.2	Number and percentage of operations site warehouses where physical inventories can be verified by daily stock records		Inventory and Stock Records Annually	Country	2,285; 100%	22; 100%	26; 100%	26; 100%	27;100%	26 ⁸⁶ ; 100%				

82 IRS only; Stores Assistants (24) and Logistics Assistants (7). SumiShield® 50WG was stored at the 2 MMD stores. Actellic® 300CS was stored in the rest of the 20 stores.

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

83 Logistics Assistant 8 (female 1), Stores Assistant 28 (female 23)

84 Logistics Assistants 8 and Stores Assistants 28

85 Actellic® 300CS (20); SumiShield® 50WG (2)

86 Three operational sites proposed for TSD reduced to two. There is a warehouse in each operations site.

#	Performance Indicator	Global Project Indicator	Data Source(s) and Reporting Frequency	Disaggregation(s)	Annual Targets and Results									
					Year 1 2018		Year 2 2019		Year 3 2020		Year 4 2021		Year 5 2022	
					Target	Result	Target	Result	Target	Result	Target	Result	Target	Result
3.2.3	Number and percentage of IRS countries that successfully completed spray operations without an insecticide stock-out	X	Inventory and Stock Records Annually	Country Insecticide Type										
4. Innovation														
4.1	Conduct operational research or monitoring to scale up new tools, methods, and approaches													
4.1.1	Number of operational research studies on promising new tools or new methods/approaches to existing tools that are implemented		Project Records Annually	Country Type of Innovation	1 ⁸⁷	1	1 ⁸⁸	1 ⁸⁹	1	1 ⁹⁰				

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

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

89 Partial spraying study

90 Vector resting behavior field observation by spraying animal shelters along with living/sleeping structures.

#	Performance Indicator	Global Project Indicator	Data Source(s) and Reporting Frequency	Disaggregation(s)	Annual Targets and Results									
					Year 1 2018		Year 2 2019		Year 3 2020		Year 4 2021		Year 5 2022	
					Target	Result	Target	Result	Target	Result	Target	Result	Target	Result
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	X	Project Records Annually	Country Technical Area										
4.2.2	Number of individual members who use the Vector Learning Exchange	X	Project Records Annually	N/A										
4.2.3	Number of symposia and/or		Project Records	Country Technical Area	1	1 ⁹¹	1	3 ⁹²	2	TBD ⁹³				

91 Pan-African Mosquito Control Association (PAMCA) (entomology) abstract accepted and presented

92 Two abstracts accepted for 2019 American Society for Tropical Medicine and Health (ASTMH) (oral and poster presentations) and one for poster presentation at Roll Back Malaria SBCC Working Group.

93 Two abstracts submitted (SBCC/Morocco and ASTMH), SBCC was not accepted, waiting for ASTMH.

#	Performance Indicator	Global Project Indicator	Data Source(s) and Reporting Frequency	Disaggregation(s)	Annual Targets and Results									
					Year 1 2018		Year 2 2019		Year 3 2020		Year 4 2021		Year 5 2022	
					Target	Result	Target	Result	Target	Result	Target	Result	Target	Result
	presentations submitted to and accepted at global conferences		Annually											
4.2.4	Number of success stories written or videos produced and shared on the VectorLink project website		Project Records Annually	Country	1	2 (1 success story on website and 1 video on recycling)	NA	1 (gender success story)	1	2 ⁹⁴				
4.2.5	Number of peer-reviewed journal articles submitted and accepted	X	Project Records Annually	Technical Area										
4.2.6	Number of contributions to vector control global or country policy and/or		Project Records Annually	Country Technical Area	N/A	N/A	1	2 ⁹⁵ IRS and ITN	1 ⁹⁶	2 ⁹⁷ IRS and ITN				

94 One on COVID-19 on PMI website and one on World Malaria Day radio show on VectorLink website

95 National Integrated Malaria Vector Management policy as a lead reviewer and as a contributor to the Malaria Program Review

96 Contribution to the National Strategic Plan for Malaria 2021-2026

97 National Strategic Plan for Malaria 2021-2026 and Malaria Program Review 2014 -2019

#	Performance Indicator	Global Project Indicator	Data Source(s) and Reporting Frequency	Disaggregation(s)	Annual Targets and Results									
					Year 1 2018		Year 2 2019		Year 3 2020		Year 4 2021		Year 5 2022	
					Target	Result	Target	Result	Target	Result	Target	Result	Target	Result
	guidance documents													
4.3	Develop and deploy cost-savings approaches													
4.3.1	Number of innovative or novel approaches implemented to achieve cost savings in IRS and integrated malaria vector control programs		Project Records	Country	1	1 ⁹⁸	1	1 ⁹⁹	1	2 ¹⁰⁰				
			Annually	VC Intervention	IRS	IRS	IRS	IRS	IRS	IRS				
4.3.2	Number of cost effectiveness assessments of existing approaches in the implementation of IRS and integrated malaria vector		Project Records	Country	N/A	N/A	N/A	N/A	N/A	N/A				
			Annually	VC Intervention										

98 One-time installation of a metal plate with IRS identification number at each targeted household, anticipated to last for the life of the project.

99 Completed procurement of motorbikes for IEC Assistants that will last for the life of the project and generate savings in the long term as compared to annual rental.

100 Mobile data collection and serialization of insecticide by scanning/barcoding. VectorLink Ghana borrowed (instead of buying) tablets from NMCP.

#	Performance Indicator	Global Project Indicator	Data Source(s) and Reporting Frequency	Disaggregation(s)	Annual Targets and Results															
					Year 1 2018		Year 2 2019		Year 3 2020		Year 4 2021		Year 5 2022							
					Target	Result	Target	Result	Target	Result	Target	Result	Target	Result						
	control programs																			
4.4	Cultivate public-private partnerships																			
4.4.1	Number of private sector entities engaged with to establish public private partnerships to increase the quality and coverage of malaria vector control activities globally		Project Records Annually	Country	N/A	N/A	N/A	N/A	1 ¹⁰¹	2 ¹⁰²										

101 Collaboration with AGAMaL on molecular analysis of mosquito samples

102 GeoGrafix Solutions engaged for digital map verification at GUD. Collaboration with AGAMaL on molecular analysis of mosquitoes