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THE PMI VECTORLINK CÔTE D'IVOIRE 2022 END-OF-SPRAY REPORT

MAY 16–JUNE 10, 2022

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ACRONYMS

BMP	Best Management Practices
CEMV	*Centre d'Entomologie Médicale et Vétérinaire* (Center for Medical and Veterinary Entomology)
COVID-19	Coronavirus Disease 2019
CSP	Community Spray Participant
CSRS	*Centre Suisse de Recherches Scientifiques* (Swiss Center for Scientific Research)
DCV	Data Control Verification
ECO	Environmental Compliance Officer
EHS	Environmental, Health, and Safety
IEC	Information, Education, and Communication
INHP	*Institut National Hygiène Publique* (National Hygiene Public Institute)
IPR	Institut Pierre Richet
IRS	Indoor Residual Spraying
ITN	Insecticide Treated Net
M&E	Monitoring and Evaluation
mHealth	Mobile Health
NMCP	National Malaria Control Program
ODK	Open Data Kit
PMI	U.S. President's Malaria Initiative
PMT	Performance Monitoring Tracker
PPE	Personal Protective Equipment
PSECA	Pre-Season Environmental Compliance Assessment
SEA	Supplemental Environmental Assessment
SMS	Short Message Services
SOP	Standard Operating Procedure
TOT	Training of Trainers
USAID	United States Agency for International Development
VCSC	Vector Control Steering Committee
WMP	Waste Management Plan

EXECUTIVE SUMMARY

In 2022, the U.S. President's Malaria Initiative (PMI) VectorLink Project in Côte d'Ivoire worked closely with the National Malaria Control Program (NMCP) to implement indoor residual spraying (IRS) in Nassian and Sakassou health districts. A total of 62,551 structures were targeted for IRS (28,068 in Nassian and 34,483 in Sakassou) with a goal to protect approximately 206,722 people, including 5,093 pregnant women and 32,730 children under 5 years.

During the 2022 IRS campaign, the VectorLink Côte d'Ivoire team worked in 20 operational sites. Prior to the spraying, the team prepared the sites for operations, deployed IRS equipment and supplies, and organized training activities at different levels (e.g., orientation sessions, training of trainers, spray operator training), all in compliance with COVID-19 preventive measures. Spraying was conducted simultaneously in both districts over 20 operational days from May 16 to June 10, 2022. Applying lessons learned from the 2020 and 2021 IRS campaigns, VectorLink Côte d'Ivoire introduced a self-mobilization which is a communication strategy which empowers Chief Village or community leaders to ensure villagers accept the spraying of their houses and facilitate population acceptance. This strategy provided a very productive mobilization and reduced costs. In 2022, the project ultimately sprayed 70,392 structures (out of the 71,474 eligible structures found) using Fludora Fusion (clothianidin and deltamethrin) in Nassian and SumiShield 50WG (clothianidin) in Sakassou. Key results are summarized in Table ES-1.

TABLE ES-1: VECTORLINK CÔTE D'IVOIRE 2022 IRS CAMPAIGN SUMMARY

	Sakassou	Nassian	Total
Insecticide used (sachet) for eligible structures	16,137	8,681	24,818
Insecticide used (sachet) for non-priority structures	138	151	**289***
Insecticide used (sachet)	16,275	8,832	**25,107**
Total targeted eligible structures	34,483	28,068	**62,551**
Cumulative eligible structures found by spray operators	41,611	29,863	**71,474**
Cumulative eligible structures sprayed	40,850	29,542	**70,392**
Population in sprayed structures	143,736 (Female 70,845) (Male 72,891)	84,695 (Female 43,292) (Male 41,403)	**228,431** **(Female 114,137)** **(Male 114,294)**
Population of pregnant women in sprayed structures	4,223	2,896	**7,119**
Population of children under 5 in sprayed structures	24,156	14,639	**38,795**
Spray progress (%) based on targeted structures	118.5%	105.2%	**112.5%**
Spray coverage (%) (based on structures found by spray operators)	98.2%	98.9%	**98.5%**
Total number of people trained to deliver IRS in targeted areas	218 (Female 10) (Male 208)	136 (Female 33) (Male 103)	**354** **(Female 43)** **(Male 311)**

* In total 289 non-priority structures were sprayed in Nassian and Sakassou Districts as requested by the district health authorities and to minimize the quantity of insecticide leftover.

During the first week of the campaign, the project conducted cone bioassays in three villages in each district to assess spray quality. Exposure to sprayed surfaces resulted in 100% mortality for both insecticides within the indicated holding period.

I. Country Background and Activity Summary

Until 2020, the main malaria vector control method used in Côte d'Ivoire was the distribution and use of pyrethroid-only insecticide-treated nets (ITNs). Distribution of these nets is typically done through either mass campaigns, or routine distribution during antenatal visits and/or immunization of children under 1 year of age to sustain coverage. The National Malaria Strategic Plans covering 2016-2020 and 2021-2025, included indoor residual spraying (IRS) as an additional vector control method to reduce malaria morbidity and mortality.

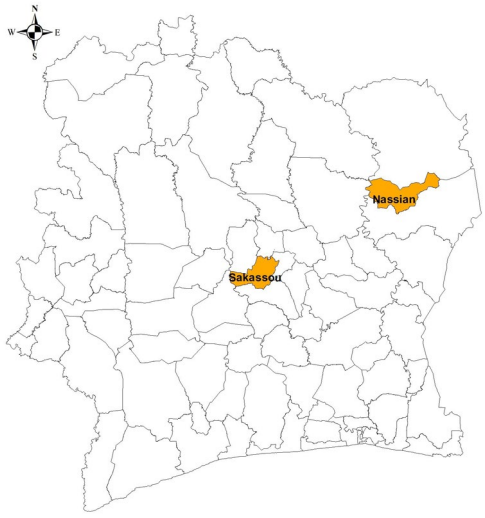
The VectorLink Côte d'Ivoire project implemented the first-ever large-community-scale IRS campaign in the Sakassou and Nassian health districts in 2020 (Figure 1). These districts were selected based on the malaria burden, the main malaria vector's full susceptibility to appropriate insecticides, and population. The selection was done in 2019 by, NMCP, PMI and the Vector control steering committee based first on the epidemiological data which showed that Sakassou and Nasian are located in the very high endemicity zones characterized by malaria incidence over 400 per 1000. Secondly, selection was also based on entomological data collected since 2018 and a geographical reconnaissance study to estimate the number of eligible structures to be targeted and population to be protected. After the first IRS campaign in 2020, the National Malaria Control Program (NMCP), the U.S. President's Malaria Initiative (PMI), and the National Vector Control Steering Committee (VCSC) agreed to conduct the second campaign in the same districts in 2021 using the same insecticides as in 2020 in each district: SumiShield 50WG in Nassian and Fludora Fusion WP-SB in Sakassou.

In the same year (2021), the PMI VectorLink Project in Côte d'Ivoire supported the NMCP to plan, coordinate, implement, and monitor the 2021 ITN mass campaign. The project also supported the distribution of 3,074,527 piperonyl butoxide (PBO) nets in 11 health districts (which did not receive IRS). These sites were selected based on entomological data generated by the project, which showed PBO partially restored pyrethroid susceptibility at these sites (i.e., increased mosquito mortality to pyrethroids by ≥10%) (Vectorlink 2019-2020 Annual Entomology Report).

In 2022, the NMCP, PMI, and the VCSC recommended conducting IRS in the same districts as in the two previous years. The VCSC recommended switching the insecticides between districts to gather residual efficacy data for each product in different settings; therefore, Fludora Fusion was sprayed in Nassian and SumiShield in Sakassou.

The project tested vector susceptibility to the insecticides used for malaria vector control in 14 new districts and conducted longitudinal vector surveillance in four districts as well as quality assurance of IRS operations and residual efficacy tests of sprayed insecticides in both IRS districts. From 2018 to 2022, the VectorLink Côte d'Ivoire Project implemented insecticide resistance monitoring in 34 districts covering24 of 33 health regions (72% of health regions) to assess insecticide suitability for vector control interventions and update the entomological profile in country.. Reports from these activities can be found on the PMI website (https://www.pmi.gov/resources/.)

FIGURE 1: PMI VECTORLINK COTE D'IVOIRE 2022 IRS DISTRICTS



2. IMPLEMENTATION OF IRS ACTIVITIES

2.1 IRS PLANNING AND PARTNERS' COLLABORATION

VectorLink Côte d'Ivoire held frequent meetings with partners involved in IRS strategies such as key staff from PMI Côte d'Ivoire, the NMCP, and other stakeholders. Together the partners validated and agreed on implementation of all necessary activities and interventions to achieve the 2022 IRS campaign objectives.

On February 15-19, 2022, VectorLink Côte d'Ivoire, in collaboration with the NMCP, facilitated a workshop of 40 participants on global Vector Control strategies including IRS and ITN Continuous Distribution. Workshop participants were from the National VCSC, Institut National d'Hygiène Publique (INHP), Centre Suisse de Recherches Scientifiques (CSRS), Institut Pierre Richet (IPR), Centre d'Entomologie Médicale et Vétérinaire (CEMV), World Health Organization (WHO), Regional and IRS District Health officials and Administrative authorities, and PMI mission team. A session on the IRS Operational Plan and activity timeline was held to share and validate a timeline of activities and any notable changes from the previous year. As PMI is not funding IRS in Côte d'Ivoire in 2023 as a strategy shift to be able to support a greater breadth of malaria interventions, the workshop discussed a post-IRS communication plan and a strategic vector control plan for the IRS recipient districts of Nassian and Sakassou; the goal of these plans is to sustain the potential gains in malaria case reductions from IRS, through the optimization of the ITN continuous distribution channels to achieve sustained high coverage of ITN. The outcomes of the workshop were to elaborate a Continuous Distribution National Guide, to mobilize funds to deploy IRS in the future, and to select two new districts as targets of malaria pre-elimination.

The project facilitated two microplanning workshops simultaneously in Nassian and Sakassou on March 10-11, 2022, to develop and validate spray calendars and communication plans with local stakeholders. A total of 59 participants (36 in Sakassou and 23 in Nassian) came from health facilities of both districts.

The project reviewed IRS training tools on April 13, 2022 and organized a virtual orientation session for a pool of national trainers that included staff from the NMCP, INHP, CSRS, IPR, and CEMV as well as members of the National VCSC. A total of 12 participants attended.

VectorLink Côte d'Ivoire facilitated various training sessions for IRS implementation and supervision to strengthen the overall skills of partners involved in IRS. On April 19-23, Training of Trainers (TOTs) sessions were held simultaneously in Bondoukou (for Nassian) and Bouaké (for Sakassou) under NMCP leadership. The TOTs covered the following topics: IRS concepts and planning, environmental compliance and personal safety, IRS monitoring and evaluation (M&E), gender awareness including Abt policy on sexual harassment, social behavior change concepts, communication and information transfer techniques, management of operational sites, insecticide and equipment handling, spray techniques, and proper use of personal protective equipment (PPE), logistics, and warehouse management, as well as training and facilitation skills and the use of GPS-equipped smartphones for mobile IRS data collection (see Section 5.1). In 2022, two health district staff selected as supervisors served in each district as co-trainers. This approach contributed to the development of human resources capacity strengthening for IRS sustainability in the country. The 57 participants in the TOT were composed of health facilities managers and personnel from Regional Health Directorates, Health District Directorates, INHP, and Ministry of Environment.

In collaboration with the NMCP, the project conducted advocacy meetings simultaneously in Nassian and Sakassou on April 26-28, 2022, to meet district-level health directors and community leaders, discuss the

importance of the communities' engagement, and disseminate information about the benefits of IRS. This year, the project initiated a new strategy of self-mobilization through which community leaders such as village chiefs were accountable as principal mobilizers with a single objective to promote 100% IRS acceptance. The strategy was very productive in improving the coverage and reducing the number of refusal cases.

The spray operator (SOP) training sessions were held simultaneously on May 9-12 at each IRS operational site level under the supervision of national teams (VectorLink Côte d'Ivoire, NMCP, and INHP). The objective was to improve the spray quality and be more efficient, and therefore, the training (which includes spray team leaders and site managers) focused on practice exercises. A total of 358 participants (including 43 women) were trained. The training included the usual spray topics as well as the use of GPS-enabled smartphones for mobile IRS data collection. At the end of the training, the project held one additional training day (May 13) for the team leaders and site managers, as well as pump technicians and storekeepers, on operations management aspects such as the roles and responsibilities of actors, code of conduct, and all restrictions and obligations in the operational sites, and the supervision approach in the field. On May 13, 42 washers and 42 security guards also received one day of training at operations sites. During SOP vehicle inspections on May 15, all 51 drivers received their training. A total of 2,017 workers were trained, including 304 women (15%), as shown in Table 1.

During the seasonal worker selection process, the District Health Officer sought to improve COVID-19 vaccine coverage in both districts by including COVID-19 vaccination in the selection criteria. The District Health Officer encouraged seasonal workers to get their COVID-19 vaccine and took opportunities during breaks in the training activities to reach unvaccinated participants from all cadres and to provide information about the COVID-19 vaccine. The team encouraged the participants to take advantage of the opportunity to get vaccinated.

TABLE 1: NUMBER OF TRAINING SESSIONS AND PEOPLE TRAINED, DISAGGREGATED BY JOB TITLE AND GENDER

Category of Persons Trained	Orientation of National Pool of Trainers		TOT		SOP Training		M&E Assistant Training		Logistics Training		Washer Training		Transport Safety and Security Training		Finance Training		Pump Repair Training		IEC Training		Total
	M	F	M	F	M	F	M	F	M	F	M	F	M	F	M	F	M	F	M	F	
National supervisors	**8**	**2**	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**10**
District supervisors*	0	0	**41**	**3**	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**44**
SOPs (including 9 substitutes)	0	0	0	0	**253**	**36**	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**289**
Team leaders	0	0	0	0	**42**	**7**	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**49**
Site managers	0	0	0	0	**20**	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**20**
Data cleaners	0	0	0	0	0	0	**4**	0	0	0	0	0	0	0	0	0	0	0	0	0	**4**
M&E assistants	0	0	0	0	0	0	**9**	**11**	0	0	0	0	0	0	0	0	0	0	0	0	**20**
Logistic assistants	0	0	0	0	0	0	0	0	**1**	**1**	0	0	0	0	0	0	0	0	0	0	**2**
Storekeepers	0	0	0	0	**15**	**5**	0	0	**3**	0	0	0	0	0	0	0	0	0	0	0	**23**
Washers	0	0	0	0	0	0	0	0	0	0	0	**42**	0	0	0	0	0	0	0	0	**42**
Drivers	0	0	0	0	0	0	0	0	0	0	0	0	**51**	0	0	0	0	0	0	0	**51**
Security guards	0	0	0	0	0	0	0	0	0	0	0	0	**42**	0	0	0	0	0	0	0	**42**
Finance assistants	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**1**	**1**	0	0	0	0	**2**
Pump technicians	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**5**	0	0	0	**5**
Mobilizers	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**1,218**	**195**	**1,413**
Site cleaner**	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	**0**	**0**	**1**
Subtotal M/F	**8**	**2**	**41**	**3**	**330**	**48**	**13**	**11**	**4**	**1**	**0**	**43**	**93**	**0**	**1**	**1**	**5**	**0**	**1,218**	**195**	**2,017**
Total (% female)	**10 (20%)**		**44 (7%)**		**378 (13%)**		**24 (46%)**		**5 (20%)**		**43 (100%)**		**93 (0%)**		**2 (50%)**		**5 (0%)**		**1,413 (15%)**		

Note: IEC=Information, Education, and Communication

*Clinicians are included in district supervisors (TOT), and they were also trained in poison management.

** The site cleaner was trained in the washer's module.

2.2 SPRAY OPERATIONS AND SUPERVISION

2.2.1 OPERATIONS SITES

VectorLink Côte d'Ivoire worked in the same 20 operations sites as in 2021 (7 in Nassian and 13 in Sakassou). The operations sites were provided to the project free of charge by the communities. All soak pits were fixed, including one in the central warehouse in Bouaké. The project rehabilitated 22 storage facilities (20 at operations sites and 2 at district level), all of which were equipped with all documents, data sheets, first aid kits, spill kits, warning signs, garbage bags, and instructions for dealing with a case of potential intoxication.

2.2.2 HUMAN RESOURCES

VectorLink Côte d'Ivoire hired 492 community members as seasonal workers, including 103 women (21%) to fill the positions outlined in Table 2. All recruitment was conducted through a formal advertisement and committee selection process in collaboration with local authorities. Before the campaign, all seasonal staff underwent a medical checkup (including pregnancy tests for women).

An additional 1,518 participants required to conduct the IRS campaign came from various government and community-based stakeholders. These positions included national supervisors (10), district supervisors (44), drivers (51), and community members (1,413).

TABLE 2: SEASONAL WORKERS HIRED FOR THE SPRAY DISTRICTS

Category	Number of Staff Hired to Support IRS						Total	Total (% Female)
	Spray Ops		Data Capture		Other			
	M	F	M	F	M	F		
Spray operators (including 5substitutes)	**249**	**36**	0	0	0	0	**285**	13%
Team leaders	**42**	**7**	0	0	0	0	**49**	14%
Site managers	**20**	0	0	0	0	0	**20**	0%
Data cleaners	0	0	**4**	0	0	0	**4**	0%
M&E assistants	0	0	**9**	**11**	0	0	**20**	55%
Ops storekeepers	0	0	0	0	**15**	**5**	**20**	25%
Washers	0	0	0	0	0	**42**	**42**	100%
Pump technicians	0	0	0	0	**5**	0	**5**	0%
Districts storekeepers	0	0	0	0	**2**	0	**2**	0%
Central storekeeper	0	0	0	0	**1**	0	**1**	0%
Ops site security guards	0	0	0	0	**36**	0	**36**	0%
District security guards	0	0	0	0	**4**	0	**4**	0%
Logistic assistant	0	0	0	0	**1**	**1**	**2**	50%
Finance assistant	0	0	0	0	**1**	**1**	**2**	50%
Total M/F	**311**	**43**	**13**	**11**	**65**	**49**	**492**	**21%**
Total (%female)	**354 (12%)**		**24 (46%)**		**114 (43%)**		**492 (21%)**	

2.2.3 KEY OPERATIONAL DETAILS AND SUPERVISION

As in 2021, VectorLink Côte d'Ivoire implemented the 2022 IRS campaign in the context of the COVID-19 pandemic with strong adherence to risk-mitigating measures as recommended by PMI VectorLink and the government of Côte d'Ivoire. The project thoroughly cleaned the 20 operations sites before the IRS campaign started and equipped all the sites with handwashing facilities, enforced social distancing of at least 2m, and always mandated the use of face masks. Spray teams practiced frequent handwashing to limit the risk of disease transmission and insecticide contamination. The team leaders and supervisors conducted a daily physical health check of all spray operators and checked their identity. If a spray operator did not feel well, they immediately

informed the district coordinator for a medical consultation. No COVID-19 case was reported during the IRS planning and implementation.

The project arranged for breakfast to be served to all IRS personnel before the start of the day's spray operations. After breakfast, spray teams changed into their project-issued PPE and gathered their equipment (mobile phone, sprayer, insecticide, etc.). Before departure for the field, a daily morning mobilization assembly was held, where the spray teams were brought together, while respecting the necessary 2m social distancing requirement. During the assemblies, important messages related to performance, recommendations, and other relevant information were announced; site managers and field supervisors briefed spray operators and team leaders on lessons learned from previous days, performance data, and expectations for the day. After retrieving the previous day's rinse water from the designated barrels, per the PMI Best Management Practices (BMP, Chandonait et al, 2020) manual, spray operators departed to the communities for the day's work. Site managers assigned spray teams to communities and allocated vehicles for transportation.

On a typical spray day, field supervisors and team leaders assigned spray operators to households designated for spraying, conducted Directly Observed Spraying, and observed homeowner preparation. Spray operators recorded spray data using the Directly Observed Spraying form with the ODK application. At the end of each day's activities, all field supervisors, team leaders, and site managers supervised end-of-day clean-up procedures at operations sites. Team leaders also summarized all spray operator 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. The M&E managers summarized the data to complete the Spray Performance Tracking Sheets, which were posted on a wall at each operations site.

In 2022, the project increased daily spray operator spray targets from 10.5 structures per spray operator per day (recorded in 2021) to 11.5 in 2022 and reduced the duration of IRS campaign from 30 to 20 operational days. This reduction in the number of days in turn reduced the length of time rental vehicles were needed for transport and the associated costs of drivers and fuel. This increased operational and unit cost efficiency. In the same vein, the project introduced door-to-door mobilization 24-48 hours before spray with the self-mobilization of chiefs of villages as principal actors for community mobilization, instead of the traditional community mobilization two weeks before the IRS campaign.

To support supervision in the field, the national and regional partners (NMCP, INHP) used a weekly rotation system during the spray campaign while VectorLink deployed one full-time technical staff to each of the 20 operations sites to conduct close supervision and take immediate corrective action as challenges arose. Over the 20 operational days, VectorLink Côte d'Ivoire held daily evening meetings under the leadership of district health authorities to discuss issues encountered, including refusals and spray calendar changes. Regional health and local administrative authorities were invited to participate in these meetings as needed. The VectorLink chief of party, NMCP coordinator, and PMI mission had regular consultative meetings or phone calls during the campaign to update and share challenges for immediate action and support.

For data collection, a total of 362 smartphones were used, 280 of which spray operators used for mobile data collection at the household level. Two smartphones were used as a gateway to the data center for the management of the job aids Short Message Services (SMS) and Performance Monitoring Tracker (PMT). The 82 remaining smartphones were used for supervision by M&E assistants (20), for insecticide sachets serialization by storekeepers (20), and for supervision by local supervisors and other supervisors including VectorLink staff and the NMCP (42).

At the end of each day, the spray operators handed their smartphones to their team leaders, who verified the Daily Spray Operator forms for completeness and accuracy and compiled the daily data before submitting them to the site managers. After data verification, team leaders proceeded with synchronization to the VectorLink Collect database server. Smartphones were also sanitized at the end of each day to minimize the risk of disease transmission during the COVID-19 pandemic.

The project rented 15 mini trucks (8 in Nassian and 7 in Sakassou) and 36 three-wheeler ATV (8 in Nassian and 28 in Sakassou) for spray operator transportation. For IRS supervision, the project used 12 vehicles (6 in

Nassian and 6 in Sakassou). Toward the end of the campaign, when SOPs were working near operations sites and transportation needs were reduced, the number of rental vehicles was reduced accordingly.

Seasonal workers, supervisors, and other actors received payments through the mobile banking payment system. With its adoption of mobile money systems for payment, the PMI VectorLink Project has helped most of the seasonal workers to get their new National Identity Card, which was a criterion to get a legal phone number registered in their own name. The mobile payment system has proven to be very effective, as it allows the project to make payments remotely in a timely, secure, and cost-efficient manner.

2.3 INSECTICIDE

Using data from previous IRS campaigns, VectorLink Côte d'Ivoire estimated a total of 25,983 units of insecticide were required for the 2022 campaign. The VCWG recommended switching the insecticides between districts in 2022; therefore, 16,495 units of SumiShield were required for Sakassou, and 9,488 units of Fludora Fusion were required for Nassian.

A total of 4,915 sachets of SumiShield 50WG remained at the end of the 2021 IRS campaign. The project procured an additional 11,580 sachets of SumiShield 50WG and 9,488 sachets of Fludora Fusion for a total of 25,983 sachets (4,915+11,580+9,488) available for the 2022 IRS campaign. The 4,915 sachets of SumiShield 50WG expiring in May 2022 were used first, according to the first-expired-the-first-out (FEFO) policy outlined in the BMP manual.

At the end of the 2022 IRS campaign, in total, 25,107 sachets of insecticides (16,275 sachets of SumiShield 50WG in Sakassou and 8,832 sachets of Fludora Fusion in Nassian) were used. Of these, 24,818 sachets (16,137 in Sakassou and 8,681 in Nassian) were used to spray eligible structures (70,392). Another 289 sachets (138 in Sakassou and 151 in Nassian) were used to spray non-priority structures such as schools, hospitals, churches, and mosques to minimize the insecticide that would be left over. A total of 876 units of insecticide remain in stock following the 2022 IRS campaign (220 sachets of SumiShield 50WG expiring in August 2024 and 656 sachets of Fludora Fusion, 396 of which expire in November 2023 and 260 of which expire in February 2024).

TABLE 3: INSECTICIDE QUANTIFICATION AND USE PER DISTRICT

Insecticide Selected	Sakassou: SumiShield	Nassian: Fludora Fusion	Total
Number of targeted structures	34,483	28,068	62,551
Expected insecticide utilization rate	2.2	3.5	2.6
Estimated number of insecticide units needed for the 2022 IRS campaign	16,495	9,488	25,983
Number of insecticide units left over after the 2021 IRS campaign	4,915	0	4,915
Number of structures sprayed	40,850	29,542	70,392
Number of insecticide units used for eligible structures	16,137	8,681	24,818
Number of insecticide units used for non-priority structures*	138	151	289
Number of insecticide units used in 2022	16,275	8,832	25,107
Actual insecticide utilization rate	2.5	3.4	2.8
Number of insecticide units remaining after the IRS 2022 campaign**	220	656	876

*289 sachets, (138 sachets of SumiShield 50WG and 151 sachets of Fludora Fusion) were used to spray non-residential structures in Sakassou and Nassian (schools, religious sites, health centers, offices, etc.).

**876 sachets remained after non-priority structures were sprayed: 220 sachets of SumiShield 50WG, all of which expire in August 2024, and 656 sachets of Fludora Fusion, 396 of which expire in November 2023 and 260 of which expire in February 2024.

2.4 INFORMATION, EDUCATION, AND COMMUNICATION ACTIVITIES AND OUTCOMES

PMI VectorLink Côte d'Ivoire, in collaboration with the NMCP and other stakeholders, supported a range of IEC activities to ensure full support for IRS activities and to promote acceptance of this intervention by the community.

VectorLink Côte d'Ivoire and the NMCP reviewed the lessons learned from the 2021 IRS campaign communication plan, to apply in 2022. They retained "zero refusal cases" as a slogan, to continue to generate a sense of collective objective. Two types of radio spots were proposed for information dissemination: one for local radio stations and another for stations with a national audience. To support communication, the project produced banners (35), posters (710), T-shirts (1,868), collared shirts (960), and caps (960) to disseminate information on IRS and bring attention to the campaign.

To optimize coverage rates and reduce community mobilization labor costs, VectorLink Côte d'Ivoire introduced the concept of self-mobilization as a communication strategy. For the implementation of this new strategy, the project deeply involved village chiefs to take advantage of their leadership, their social networks, and methods of communication to share key information concerning the IRS campaign such as spraying dates for their localities.

Under the auspices of the District Health Officer and with the support of the administrative authorities, the project met with 362 village chiefs (219 in Sakassou and 143 in Nassian) from April 26-28 to orient the village chiefs as mobilizers. The orientation explained IRS key messages and advantages to facilitate population acceptance. In this new model, the village chief is the central element of the communication system and uses his/her power of persuasion to convince villagers to accept the spraying of their houses. The chiefs met with the village population to share IRS key information and messages in the local language and, with project guidance, addressed common myths and misunderstandings about IRS. The chiefs were supported by youth volunteers who conducted door-to-door visits to share key messages about malaria prevention and household responsibilities pre- and post-spray, and to collect mobilization data. When a refusal case persisted, the village chief elevated it to the higher administrative authority, who was the community's government representative. This new approach to community mobilization strengthened community-level health systems and promoted more cost-effective, localized, and sustainable IRS capabilities. As a community mobilizer, each village chief's objective was to ensure 100% of households within his/her community accepted the IRS, and the approach did ultimately increase IRS acceptance rates. PMI VectorLink achieved 98.5% spray coverage across both IRS target districts (compared to 96.7% the previous year) and exceeded both districts' spray targets: 105% in Nassian and 118.5% in Sakassou (compared to 110.8% in Nassian and 97.4% in Sakassou in 2021)[1]. These results were higher than previous IRS campaigns and could improve malaria health outcomes in both districts.

IEC data collectors were selected by the village chiefs and health facility managers within their own community and trained to conduct door-to-door mobilization activities two days before the IRS campaign started (May 14-15). A total of 1,413 mobilizers (1,051 IEC data collectors and 362 chiefs of villages) were identified (708 in Nassian and 705 in Sakassou) including 195 women. They educated the population on malaria prevention strategies with an emphasis on IRS and its benefits, and on preparing households before the arrival of spray teams. Following their intervention, 27,345 households (10,536 in Nassian and 16,809 in Sakassou) with an estimated population of 95,919 (33,671 in Nassian and 62,248 in Sakassou) were reached. Among households reached, 97.5% (26,654) received education, with an IRS acceptance rate of 98.01% (26,125) (Table 4). The IRS non-acceptance rate was higher in Sakassou (2.8%) than in Nassian (0.7%), although both rates were very low.

[1] Reported results include residential structures only, and do not include non-priority structures sprayed to minimize leftover insecticide.

TABLE 4: RESULTS OF DOOR-TO-DOOR ACTIVITIES

IEC Mobilizer Indicators	Nassian	Sakassou	Total
Population reached	33,671	62,248	**95,919**
Households reached	10,536	16,809	**27,345**
Households sensitized	10,418	16,236	**26,654**
Households not sensitized*	118	585	**703**
Households accepting IRS	10,344	15,781	**26,125**
Household not accepting IRS**	74	453	**527**
IEC data collectors	708	705	**1,413**

* People were not sensitized because no people found, or sometime people higher than 15-year-old are not present.
** People not accepted IRS, sometimes they related the heavy baggage to move, or some time they gave no reason.

To share key messages and obtain acceptance of IRS from household heads who were not present during the spray campaign, the team used local radio to broadcast targeted IRS information to heads of households in the two target districts: 345 spots and messages (135 in Nassian and 210 in Sakassou) were broadcast in four local languages (Koulango, Lobi, Malinké, and Baoulé) through two local radio station networks (Boutourou in Nassian and Walèbo in Sakassou) (Table 5). Information also went out on two radio stations that broadcast nationally (Albayane, RTI-1).

TABLE 5: IEC ACTIVITIES CONDUCTED OVER THE RADIO

Location	Type of Radio Show	Number of Broadcasts
Nassian	Short radio spots and messages (in French and the two main local languages: Koulango and Lobi)	135
	Debates and (interactive) discussion shows	5
Sakassou	Short radio spots and messages (in French and the two main local languages: Malinké and Baoulé)	210
	Debates and (interactive) discussion shows	1
National	Short radio spots and messages in French	07

Through visits to key actors, advocacy meetings have deeply involved all 362 village chiefs and 364 town criers in the communication process, specifically in the dissemination of IRS information and messages, to better improve population acceptance. Refer also to section 5.3 (Results).

Community mobilizer in Koutouba operations site, Nassian District. Photo Credit: Biba Etien Coulibaly, VectorLink IEC Coordinator

Community meeting in Belakro operations site, Sakassou District. Photo Credit: Biba Etien Coulibaly, VectorLink IEC Coordinator

IRS launch ceremony with Prefect, (name of the prefet) and CDC Malaria Resident Advisor, Dr Patricia Yepassis-Zembrou, visiting the first structure sprayed in Sakassou District. Photo Credit: Modeste Djahan, VectorLink District Coordinator

Local authorities supervise spraying of first structure in Nassian District. Photo Credit: Biba Etien Coulibaly, VectorLink IEC Coordinator

The NMCP chose May 16 as the date for the official and simultaneous district launch ceremonies of the 2022 IRS campaign. In the presence of health, religious, traditional, cultural, and administrative authorities, the NMCP, PMI team, project representatives, and department prefects kicked off the campaign. A total of 337 people participated in the ceremonies (159 in Nassian and 178 in Sakassou) in the two districts.

2.5 CAPACITY BUILDING

In 2022, VectorLink Côte d'Ivoire continued supporting the development of the NMCP's human resources and partners' institutional capacity through entomological monitoring activities and IRS implementation.

With project guidance, the NMCP vector control specialist successfully created a vector control unit within the NMCP malaria prevention department. A memorandum from the NMCP director was shared with stakeholders including NMCP staff and implementation partners who worked with NMCP. This unit coordinates nationwide entomological monitoring activities, in collaboration with the other national entomological institutes.

Based on the capacity-building plan developed after the national entomological assessment in 2021, VectorLink Côte d'Ivoire supported the enhancement of entomological capabilities through insectary and facility rehabilitation of the CEMV laboratory animal shelter. In 2022, the project finalized the rehabilitation of the

INHP insectary, and supported the IPR with equipment (polymerase chain reaction machine) and supplies. In January 2022, VectorLink delivered laboratory equipment that will allow local research institutes to increase the breadth and quality of their vector control monitoring activities and better support the NMCP vector control unit to plan and monitor appropriate vector control interventions.

Also in 2022, the project continued to coach the NMCP and other IRS stakeholders at all levels (national, regional, and district) to reinforce their capacity in planning, supervision, and monitoring of a high-quality IRS campaign for a future sustainability of IRS in Côte d'Ivoire. The project in collaboration with the NMCP and districts selected four supervisors (2 per district) as trainers to ensure lasting local human resources capable of performing high-quality IRS training. In addition, the self-mobilization approach described in section 2.4 represents another dimension of IRS capacity strengthening, as it increases the potential for IRS to be sustainable and affordable to the government. At the subnational level, the project continued to develop IRS skills within regional and district authorities such as reinforcing the capacity of regional environmental workers by tasking them with environmental inspections. The project conducted a series of training on practical IRS skills for 10 national-level NMCP staff and stakeholders, and 44 regional and district health staff, who served as IRS supervisors. In addition, the project also trained 2,017 seasonal workers, most of whom are Community Health Workers, to carry out community mobilization and spraying in their own communities. With this approach, the Community Health Workers represent a skilled workforce with potential to conduct IRS activities in future years.

2.6 GENDER MAINSTREAMING

VectorLink Côte d'Ivoire continued to encourage the integration of women into IRS by creating a safe work environment for all workers, sensitizing communities on the recruitment of women in the project, integrating rate of women participating in spraying campaign into a friendly competition between sites for recognition of accomplishments, and posting project gender awareness guidelines and harassment posters in all operations sites.

From 2020 to 2022, globally, the percentage of women taking part in IRS activities decreased from 19% (2020) to 15% (2022). Despite a slight percentage increase in women hired as spray operators in 2022 (from 10% in 2021 to 13%) and women in supervisory roles (21% in 2021 and 22% in 2022) (Table 6), challenges remained with recruitment of women due to the misconception that IRS work is for men because it is physically demanding (involving carrying and operating heavy IRS equipment) and/or because of increased domestic care work. The project continued advocacy to change this misconception by rewarding female spray operators and giving female applicants preference during recruitment. The positions with the highest percentage of female participation were washers (100%) and M&E assistants (55%).

TABLE 6: SUMMARY OF GENDER-RELATED INDICATORS, 2020-2022

Years	Women Trained to Support IRS	Women Hired to Support IRS	Women Hired in Supervisory Roles*	Women Hired as Spray Op.	Women Hired as Team Leaders
2020	**19% (213)**	**22% (195)**	**20% (29)**	**16% (38)**	**14% (7)**
2021	**19% (163)**	**20% (143)**	**21% (18)**	**10% (19)**	**17% (7)**
2022	**15% (306))**	**21% (103)**	**22% (18)**	**13% (36)**	**14% (7)**

* Includes only team leaders, site managers, and M&E assistants.

3. ENTOMOLOGY

Entomological activities assess vector susceptibility to the insecticides that are used to control malaria vectors, the quality of IRS operations, and the residual efficacy of sprayed insecticides.

3.1 IRS SUSCEPTIBILITY

In 2022, the project collected larvae in the Nassian and Sakassou IRS sites and in 16 non-IRS sites located across different ecological zones of Côte d'Ivoire. *An. gambiae* s.l. larvae were collected and reared to adulthood at the district laboratories, and WHO susceptibility tests using pirimiphos-methyl (0.25%) and clothianidin (2%) were conducted on 2-5-day-old adult mosquitoes following the PMI Standard Operating Procedure (SOP 06/01). As observed in 2020, and in 2021, *An. gambiae* s.l. were susceptible to pirimiphos-methyl in Nassian (100% mortality 24h post exposure) and resistant in Sakassou (88.6% mortality 24h post exposure), while susceptibility to clothianidin was recorded in both sites (100% mortality 120h post exposure).

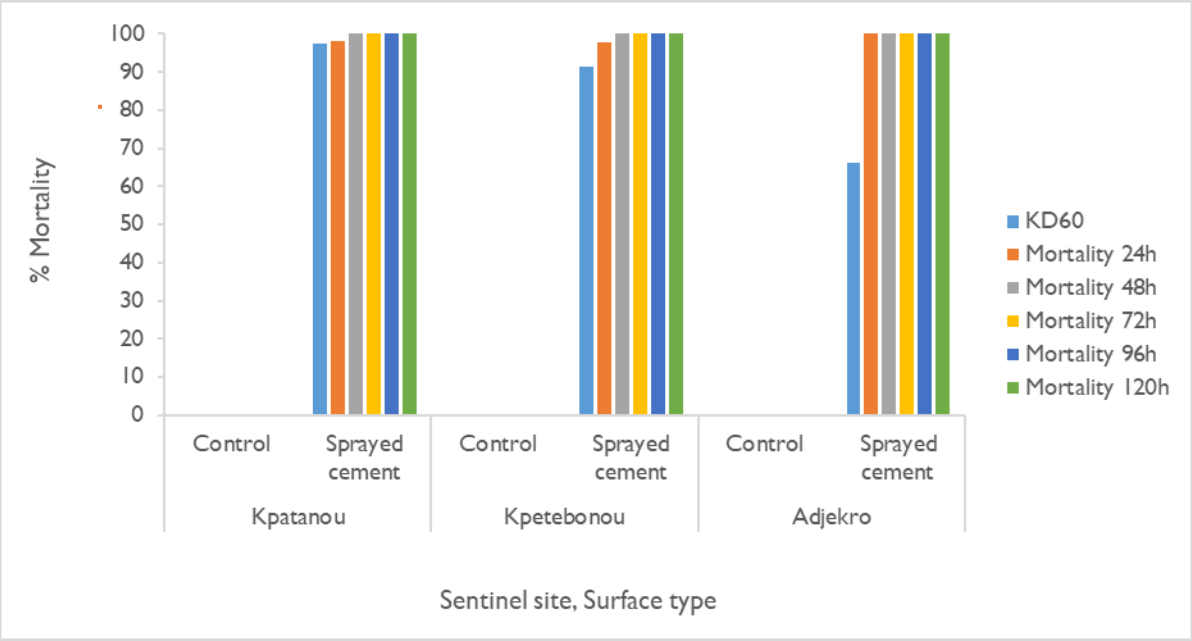
3.2 QUALITY ASSURANCE AND RESIDUAL EFFICACY SELECTED STRUCTURES

Mud and cement walls were the two main types of surfaces found in Nassian, while all walls in Sakassou are made of cement. Three to five sprayed structures were selected in each of the six test sites. In addition to the sprayed structures, one unsprayed structure (ineligible due to food storage) was used for control bioassays in each of the sites.

Spray quality was assessed using wall cone bioassay tests as a proxy indicator of IRS quality. Cone bioassays were conducted in three villages in each of the two IRS districts within 2-4 days of spraying. In Nassian, the tests were conducted in Parhadi, Lande, and Nassian city. In Sakassou, the tests were conducted in Adjekro, Kpatanou, and Kpetebonou. The villages surveyed were selected for convenience due to their easy access and favorable monitoring conditions. Three to five houses per village, that were sprayed by different spray operators, were used for quality assurance and fumigant effect test, for a total of nine houses in Sakassou and 12 in Nassian. The susceptible mosquito colony (*An. gambiae* Kisumu strain) from the IPR insectary in Bouaké was used for the quality assurance and residual efficacy cone bioassays, following PMI SOP 09/01. Wild *An. gambiae* s.l. from each site were also used in parallel to test the efficacy of sprayed insecticides against the native pyrethroid-resistant vector population.

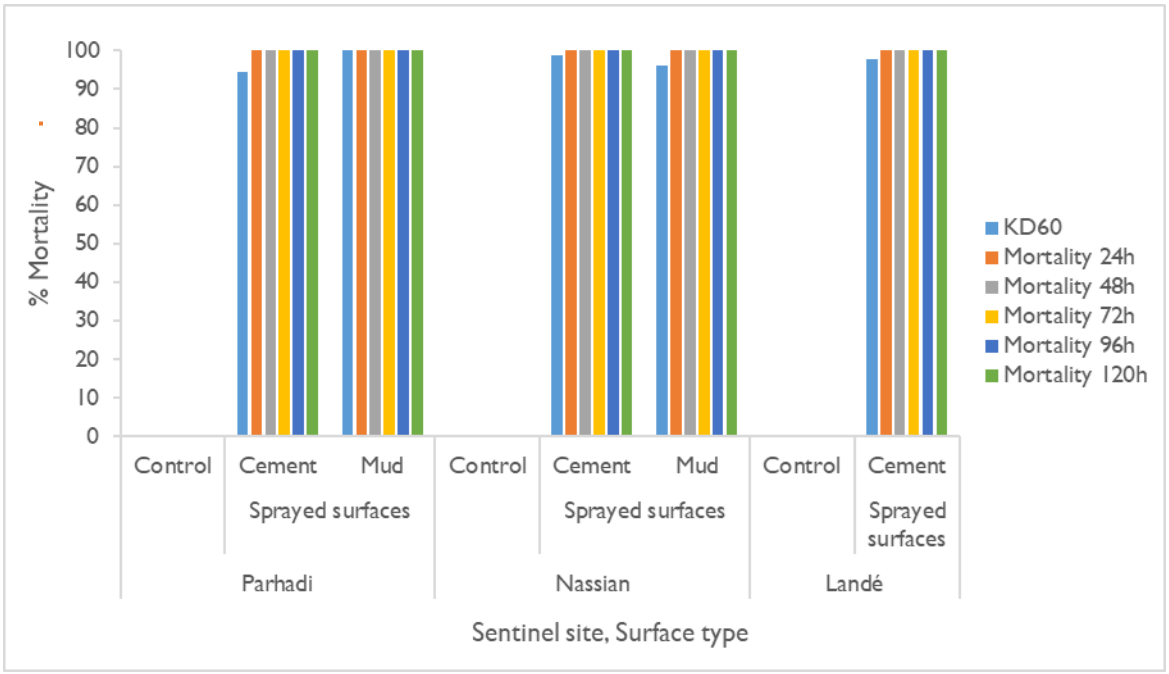
Exposure of *An. gambiae* Kisumu to SumiShield-treated cement walls in Sakassou yielded 100% mortality after a 24-48-hour holding period (Figure 2). Exposure to Fludora Fusion-treated walls (mud and cement) in Nassian yielded 100% mortality within 24 hours for both cement and mud surfaces (Figure 3). There was no mortality in the control cones.

FIGURE 2: SPRAY QUALITY ASSURANCE RESULTS AT T0 OF SUMISHIELD-SPRAYED WALL CONE BIOASSAY IN SAKASSOU USING *AN. GAMBIAE* KISUMU



*The red line represents the 80% efficacy threshold.

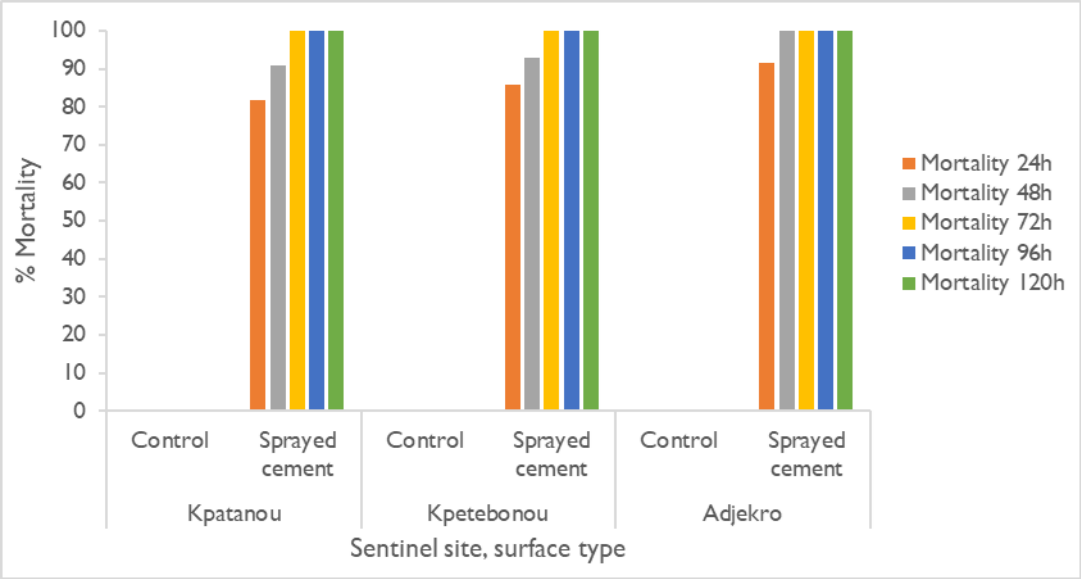
FIGURE 3: SPRAY QUALITY ASSURANCE RESULTS AT T0 OF FLUDORA FUSION-SPRAYED WALL CONE BIOASSAY IN NASSIAN USING *AN. GAMBIAE* KISUMU



**The red line represents the 80% efficacy threshold.*

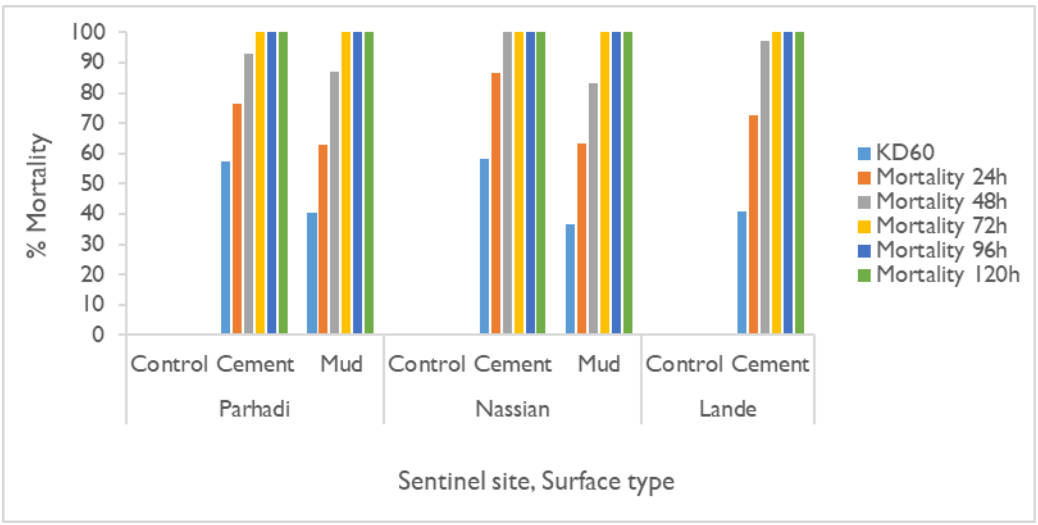
Exposure of wild *An. gambiae* s.l. from Sakassou to SumiShield-treated cement walls yielded 100% mortality after a 48-72-hour holding period (Figure 4). Exposure of wild *An. gambiae* s.l. from Nassian to Fludora Fusion-treated walls (mud and cement) yielded 100% mortality on both surface types between 48 and 72 hours (Figure 5).

FIGURE 4: SPRAY QUALITY ASSURANCE RESULTS AT T0 OF SUMISHIELD-SPRAYED WALL CONE BIOASSAY I SAKASSOU USING WILD *AN. GAMBIAE* S.L.



**The red line represents the 80% efficacy threshold.*

FIGURE 5: SPRAY QUALITY ASSURANCE RESULTS AT T0 OF FLUDORA FUSION-SPRAYED WALL CONE BIOASSAY IN NASSIAN USING WILD *AN. GAMBIAE* S.L.



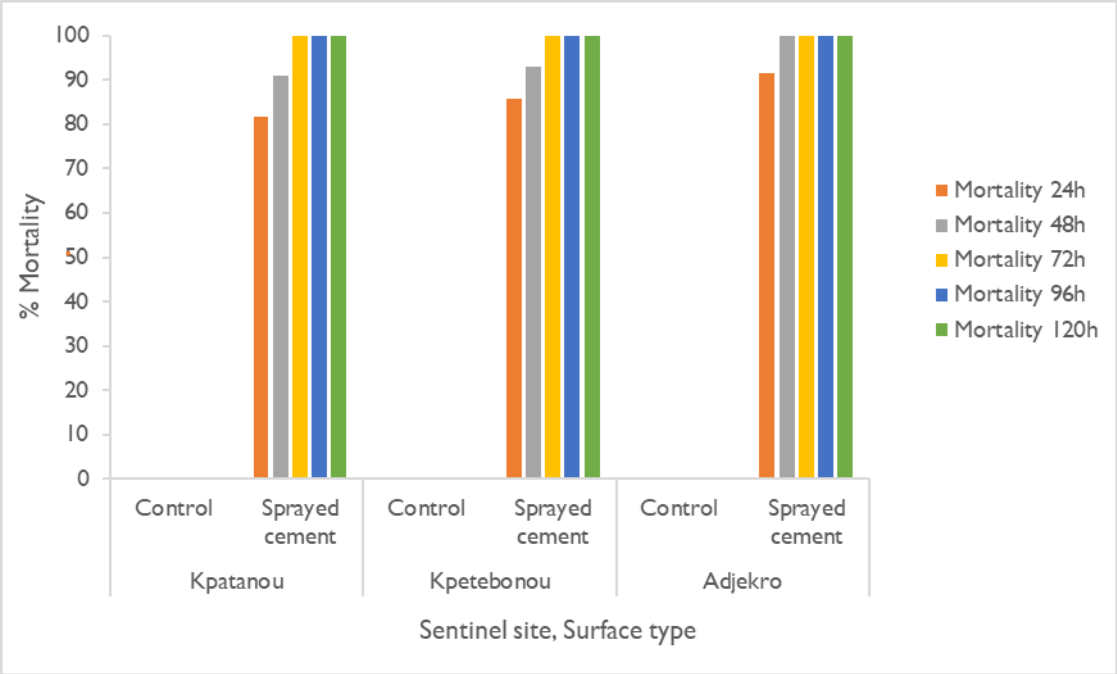
**The red line represents the 80% efficacy threshold.*

3.3 FUMIGANT EFFECT

Fumigant bioassays were also conducted in one house in each of the villages to assess the contribution of the airborne effect of the insecticide to the mortality in cone bioassays, according to PMI SOP17/01.

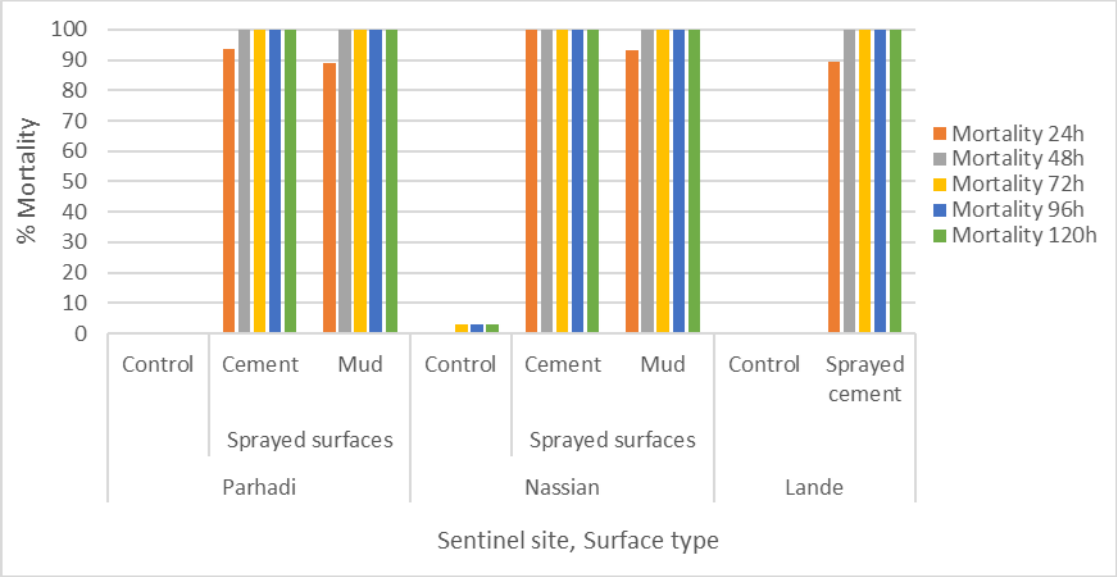
Full mortality (100%) was observed in 48-72 hours after exposure to the SumiShield-sprayed houses in Sakassou (Figure 6) and 24-48 hours for Fludora Fusion-sprayed houses in Nassian (Figure 7). There was no mortality in the control cones.

FIGURE 6: RESULTS OF SUMISHIELD-SPRAYED WALL FUMIGANT EFFECT IN SAKASSOU USING *AN. GAMBIAE* KISUMU



**The red line represents the 50% fumigant effect cut-off point.*

FIGURE 7: RESULTS OF FLUDORA FUSION-SPRAYED WALL FUMIGANT EFFECT IN NASSIAN USING *AN. GAMBIAE* KISUMU



**The red line represents the 50% fumigant effect cut-off point.*

The result of 100% mortality recorded within 48 to 72 hours after exposure to both insecticides on both wall types in both IRS districts indicates that the spraying was of good quality. Monthly monitoring of residual efficacy will be performed using susceptible *An. gambiae* Kisumu and wild collected *An. gambiae* s.l. (whenever possible) from each locality until mortality drops below 80% for two consecutive months.

4. ENVIRONMENTAL COMPLIANCE

The PMI VectorLink Côte d'Ivoire project operated under a Supplemental Environmental Assessment approved by USAID and the National Agency of Environment of Côte d'Ivoire in 2020. The assessment authorizes the use of pyrethroids, organophosphates, carbamates, neonicotinoids, clothianidin/deltamethrin combination, and pyrrole (chlorfenapyr) (when listed by WHO Pre-Qualification). In 2022, the VCSC recommended swapping the insecticides between the IRS districts. Fludora Fusion was sprayed in Nassian and SumiShield in Sakassou to monitor their efficacy in these districts.

While the VectorLink Côte d'Ivoire Environmental Compliance Officer (ECO) has primary responsibility for the environmental compliance component of the project, with the support of the home office Regional Environmental Compliance Manager providing technical assistance for the process, the NMCP's representative for environmental compliance and the provincial environmental compliance officer who covered each IRS district participated in environmental inspections. By including them, the project continued to strengthen its counterparts' capacity in environmental compliance for IRS activities and ensure that they are cognizant of PMI's BMP guidelines (as revised in 2020).[2]

4.1 IRS CAMPAIGN ASSESSMENTS

4.1.1 PRE-SEASON ENVIRONMENTAL COMPLIANCE ASSESSMENTS

Prior to the 2022 campaign, the VectorLink Côte d'Ivoire team conducted an initial Pre-Season Environmental Compliance Assessment (PSECA) and other operations using smartphones with PMI standard environmental compliance checklists. Initial PSECAs assess operations sites and identify all renovations the sites need to be ready for IRS operations, including for acquisition of insecticide in time for a successful campaign. The 2022 campaign rehabilitated and used all 20 fixed soak pits that had been used in 2021.

Approximately two weeks before the spray activities began (May 16-June 10), the project performed a final PSECA to verify that all necessary work had been completed, and that the facilities were ready to receive insecticide shipments prior to spray operations. Finally, the team held a meeting with project headquarters to authorize delivery of insecticides to all sites.

4.1.2 ENVIRONMENTAL COMPLIANCE ACTIVITIES DURING THE CAMPAIGN

VectorLink Côte d'Ivoire's staff supervised spray operations and ensured that the environmental compliance standards specified in the PMI BMP Manual were met, including the proper use of PPE, progressive rinsing of spray pumps, condition of vehicles/ three-wheeler ATV used to transport spray teams and insecticides, and storage conditions of IRS materials, as well as the display of warning signs at warehouses. The staff also closely monitored the proper management and storage of IRS waste, accuracy of the stock cards at the warehouse level, and use of proper spray techniques by spray operators. In addition, the supervision team ensured that beneficiaries had received clear information about the IRS campaign and knew how to prepare their structures for spraying. The project monitored the condition of fixed soak pits on a regular basis to ensure proper flow and drainage. The ECO trained logistics assistants inspected vehicles and three-wheeler ATVs to ensure they were fit to transport spray operators and materials to the field.

[2] https://d1u4sg1s9ptc4z.cloudfront.net/uploads/2021/03/2020-bmp-manual-revision-final-3-16-20-sxf-2-1.pdf

4.1.3 Post-Spray Environmental Compliance Activities

At the end of the 2022 spray campaign, VectorLink Côte d'Ivoire cleaned all IRS materials. The project then transported all materials and equipment from IRS sites to the two district warehouses. The project team conducted post-spray site decontamination of operations sites, cleaning all facilities with detergent and disinfectant water, washing all equipment (chaises, table) used by spray operators and removing all pictograms, and covering soak pits.

The project contacted community leaders who provided the operations sites and asked if they wanted to keep wash areas for domestic activities such as clothes-washing. Most of the communities decided not to keep the soak pits but wanted to keep the wash areas. All soak pits will be decontaminated and destroyed under ECO supervision following the required waiting period of three months before restoring them to their previous condition.

On June 13-17, 2022, VectorLink Côte d'Ivoire performed a post-spray inspection of the central warehouse, district warehouses, and all operations sites in Nassian and Sakassou in collaboration with the Regional Environment Directorate. The inspectors ensured that the soak pits were properly closed and secured. The inspection team reported on the compliance of the 2022 IRS campaign with IRS standardized best practices for warehousing, human safety, and environmental protection.

4.2 Insecticide Tracking

In 2022, VectorLink Côte d'Ivoire rolled out the use of bar codes for insecticide management in all 20 sites. The stock was managed via smartphones provided to storekeepers. The project has developed and integrated three forms (insecticide units issued, returned empty, and returned full) in an ODK application for digital scanning and electronic recording of the insecticide serial numbers. The project trained all storekeepers on electronic scanning of insecticide sachets. In parallel, the storekeepers used insecticide tracking sheets as usual to track the insecticides that team leaders received from and returned to each operations site each day.

Digital insecticide tracking allowed VectorLink to better monitor insecticides stocks by detecting the insecticide stock imbalances each day. Storekeepers were able to complete their work faster in this campaign than in the last campaign, and with the minimum risk of errors.

4.3 Incident Reports

One vehicle incident, resulting in minor injuries to a community person uninvolved in the IRS campaign, (Table 7) took place during the 2022 IRS campaign and was promptly reported to PMI.

Table 7: Incidents Recorded during the 2022 IRS Campaign

Incident	Location	Date
Vehicle and Transport Accidents	Sakassou town	June 7, 2022

4.4 Demobilization and Waste Management

Under the ECO's supervision, all solid waste generated from the 2022 spray campaign was collected and separated. The team collected all empty insecticide sachets, used masks, used gloves, plastic sheets, and flashlight batteries, and reconciled the numbers in ledger books and stock cards.

With support from the NMCP, VectorLink signed an agreement with RMG (a private incinerator) for the incineration of empty SumiShield and Fludora Fusion sachets, other contaminated items (such as used masks and latex gloves), absorbent papers, empty boxes, and non-recyclable plastic wastes. All recyclable plastic wastes will go to Conceptos Plasticos for recycling. Table 8 shows the solid wastes, and disposal methods and sites.

TABLE 8: WASTE GENERATED DURING THE 2022SPRAY CAMPAIGN AND PLANNED MANAGEMENT METHODS

Type of Waste	Content	Quantity	Disposal Method	Estimated Date of Transfer to Disposal Site
Recyclable plastic materials	Plastic	648,04 (Kg)	Recycling	August 2022
Non-recyclable plastic	Polyethylene	259 (Kg)	Incineration	August 2022
SumiShield and Fludora Fusion empty sachets	Aluminum sachet	278 (Kg)	Incineration	August 2022
Other waste (garbage bags, absorbent paper, empty boxes, etc.)	Paper, biodegradable materials, latex gloves	113 (Kg)	Incineration, repurposing	August 2022
Contaminated masks	Synthetic polymer fibers	97(Kg)	Incineration	August 2022
Flashlight batteries	Alkaline	186 (Kg)	Destruction	August 2022

5. MONITORING AND EVALUATION

5.1 DATA COLLECTION/ENTRY/QUALITY ASSURANCE

For the 2022 IRS campaign in Côte d'Ivoire, the project used standard data collection tools, including mobile devices, to record and monitor spray data within the DHIS2 platform, VectorLink Collect. This system facilitated access to near real-time spray coverage and progress results, which were used to assist monitoring and targeted planning of mop-up activities. The data collection tools included chalk markers, Daily Spray Operator forms, Team Leader Daily Summary forms, Directly Observed Spraying forms, and the mobile health (mHealth) tools (Section 5.2).

The VectorLink Côte d'Ivoire team used the ODK application on Android smartphones for mobile data collection. Before the 2022 spray campaign began, the project trained M&E assistants, data cleaners, supervisors, team leaders, and spray operators on the data collection process and on completing all appropriate forms and applications using smartphones. The mobile data collection facilitated daily reporting and operational decision making throughout the spray campaign. Specifically, the ODK application automatically generated formatted IRS numbers to help spray operators properly mark the structure, to reduce the possibility of duplicate IRS numbers. At the end of each day, the team leader verified the data collected by the spray operators and, with the help of M&E assistants, ensured that the forms were properly filled out before they were synchronized to the VectorLink Collect server. The daily summary table generated by the ODK application was used by the team leader, as a quality assurance tool, to fill the Team Leader form. The site manager and the M&E assistant then referenced the Team Leader form to fill in the PMT form.

An M&E assistant was assigned to each operations site, to train spray operators, team leaders, and site managers on data collection. During the campaign, the M&E assistant was the first line of technical support in the field and assisted the spray operators in data collection via smartphone, marking of the structures, and the data synchronization at the end of the workday.

M&E assistant Quattara Gninyeri Etienne checks mobile data collection.*Photo Credit: Ndombour Gning Cisse, VectorLink Côte d'Ivoire Chief of Party*

USAID Malaria Data Management Specialist, Melaine Tape, checks mobile data collection in Belakro in Kangre (Sakassou District).*Photo Credit: Ndombour Gning Cisse, VectorLink Côte d'Ivoire Chief of Party*

The IRS campaign supervisors also carried out daily data control verifications (DCV) on a random sample of the structures recently visited by the spray operators. The data from the DCV were compared with those of the spray operators, and corrective measures were taken if a deviation of more than 10% was observed in a locality.

PMI VectorLink's team created two WhatsApp groups to facilitate exchanges by sharing experiences, progress data, challenges, and solutions. The first WhatsApp group was created for the M&E assistants and the second was for all supervisors, including the VectorLink Senior Management Team and the Health Authority in both districts to monitor challenges for immediate actions.

The VectorLink Collect Dashboard and data from the PMT were analyzed daily through logical controls to ensure data quality and to inform stakeholders of progress.

5.1.1 VECTORLINK COLLECT DATABASE

Before the campaign started, the M&E and Operations teams worked together to gather the metadata needed for the database configuration. These data include geographical hierarchies of target areas, spray operator code assignments, ODK application development, campaign spray targets, dashboard development, and user account creation.

The VectorLink team created accounts for key stakeholders (like PMI, NMCP, district staff, and the VectorLink Senior Management Team) to access the VectorLink Collect database, and provided an orientation on how to use the database and access the dashboard. This availability of real-time data for actors made it possible to monitor the progress of each operations site, each health area, and each locality. When performance in an area was found to be weak, teams discussed the issue and found timely solutions.

5.1.2 DATA MONITORING AND CLEANING PROCESS

The data-cleaning activities were carried out in two steps:

(1) *During the campaign,* to ensure the quality of data, monitoring used cross-references of logic variables (e.g., number of insecticide sachets used per room compared with stock inventory, the average number of rooms per enumerated structure compared with the average number of rooms per structure found during the IRS, and the number of enumerated structures compared with the structures found during IRS in the same locality). When data were missing, this was immediately corrected in collaboration with the field teams. Daily checks for data anomalies were also conducted, such as excessively high or low numbers of structures sprayed.

(2) *At the end of the campaign,* the team held a workshop with the M&E assistants to ensure the synchronization of all the forms and to receive feedback from the field. There was also a database-cleaning workshop with the data cleaners using the different data cleaning tools (which concluded on June 17).

5.2 MHEALTH

To ensure rapid decision making across the various program components, the project continued to use mHealth applications to complement the CommCare tools used throughout the project with the technical support of PMI VectorLink partner Dimagi. The complementary mHealth tools were designed in ODK. The mHealth reporting tools for data collection, which VectorLink Côte d'Ivoire used throughout the spray campaign, included the PMT, job aids, and mobile supervisory forms.

During the 2022 IRS campaign, a total of 10,915 SMS messages (average: 545 per day) were sent to 349 seasonal staff. For the supervision, 6,611 forms were successfully completed by national supervisors and site coordinators through the CommCare application. Table 9 provides a breakdown of the submitted forms.

TABLE 9: SUBMITTED SUPERVISORY FORMS DURING THE SPRAY CAMPAIGN

Supervisory Form	ODK Submitted	CommCare Submitted
Morning Mobilization	50	511
Transportation Vehicle/ three-wheeler ATV Inspection	9	306
Homeowner Preparation and Spray Operator Performance	298	1426
End-of-Day Clean-up	51	434
Storekeeper Performance	43	172
DCV-data verification	0	3311
TOTAL Number of supervision forms =6611	**451**	**6160**

5.3 RESULTS

The M&E plan tracks performance and progress across the different components of the project based on the following key objectives: implementation of vector control interventions, entomological and epidemiological data to drive decision making, support of the delivery and storage of IRS commodities and other vector control products, and innovation. The M&E plan indicator matrix (Annex A) shows how PMI VectorLink Côte d'Ivoire has performed against these indicators.

To monitor the performance of the spray campaign, key indicators were tracked throughout the campaign: structures targeted, structures found, the proportion of structures sprayed out of those targeted (spray progress), and the proportion of structures sprayed out of those found (spray coverage). Also, during the campaign, the project collected household population details to report the number of people protected. This included the total population disaggregated by gender and special groups, such as pregnant women and children under 5 years.

During the 2022 IRS campaign, the project found a total of 71,474 structures (41,611 in Sakassou and 29,863 in Nassian) and sprayed 70,392 structures (40,850 in Sakassou and 29,542 in Nassian). The campaign achieved an overall coverage rate of 98.5% (98.2% in Sakassou and 98.9% in Nassian).

Table 10 provides a summary of key results.

TABLE 10: SUMMARY OF 2022 KEY IRS RESULTS

Districts	Structures Found by SOPs	Structures Sprayed	Spray Coverage	Population Protected	Pregnant Women Protected	Children <5 years Protected
Sakassou	**41,611**	**40,850**	**98.2%**	**143,736**	**4,223**	**24,156**
Nassian	**29,863**	**29,542**	**98.9%**	**84,696**	**2,896**	**14,639**
Total	**71,474**	**70,392**	**98.5%**	**228,432**	**7,119**	**38,795**

A total of 1,082 eligible structures found (321 in Nassian and 761 in Sakassou) were not sprayed during the 2022 campaign (Figure 8). Among them, locked houses represent 46%; refusal cases 39% due skepticism or unwillingness to move their belongings outside; presence of a sick person (9%); other such as weddings, or additional ceremonies (5%); and funeral (1%). From 2020 to 2022, the refusal rate among the structures found gradually decreased from 2.6% (2020) to 1.1% (2021) to tend towards 0% in 2022 (Figure 9). Two potential reasons could be that, in 2022, there was the introduction of the self-mobilization approach, and the scheduling of spraying while school was in session. In 2020 and 2021, IRS were conducted during school holidays, so many structures occupied by students and teachers were locked during this period of vacation.

FIGURE 8: REASONS FOR NON-SPRAYED STRUCTURES IN CÔTE D'IVOIRE

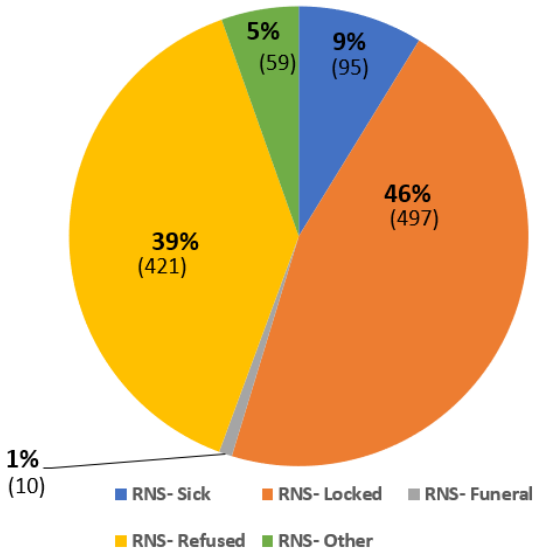
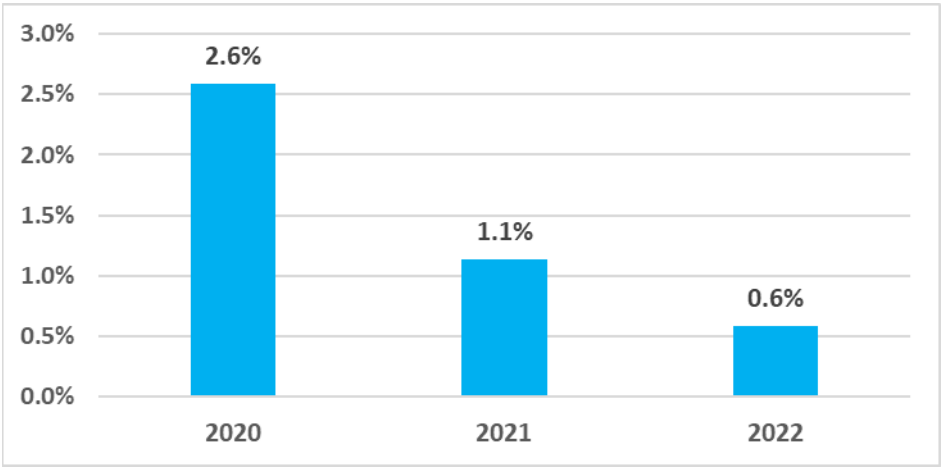


FIGURE 9: NUMBER OF REFUSALS CASES FROM 2020 TO 2022 IN CÔTE D'IVOIRE



6. CHALLENGES, LESSONS LEARNED, AND KEY RECOMMENDATIONS

6.1 CHALLENGES

Supervision checklist: Erroneous red flags continued in 2022 despite the training the project conducted with supervisors. Supervisors made mistakes and did not pay close attention when completing their daily supervisory reports in ODK. The project received the feedback through mHealth and shared it with the senior management team who clarified that those errors were red flags. For example, some supervisors incorrectly reported that some insecticide had expired. For future IRS campaigns, the project recommends not rehiring supervisors who do not correctly use the checklist for supervision of IRS.

Women's participation: Women's participation in IRS work remained low (22% women hired in supervision roles) in 2022 despite the project's advocacy and orientation on the importance of gender integration. For the future, the project recommends involving the Ministry of Woman, Family and Children and having a clear plan for gender inclusion and to dispel myths around IRS workers.

Structures locked and some refusals cases: The main reasons for eligible structures not being sprayed were locked (46%) and refusals cases (39%). The absence of structure owners is due to farm work in both districts during this period.

6.2 LESSONS LEARNED

By the end of the 2022 IRS campaign, the project team had learned many lessons, including the following:

- The self-mobilization approach promotes and increases the likelihood of IRS sustainability by increasing the knowledge and communication skills of respected community leaders, who disseminate accurate information about and encourage the acceptance of IRS by community members.
- The adoption of cost-reducing strategies--such as shortening the duration of the 2022 IRS campaign, by reducing in the number of days in turn reduced the length of time rental vehicles were needed for transport and the associated costs of drivers and fuel. In additional the number of rental vehicles from 127 in 2020 and 51 in 2021 and 2022. The project introduced door-to-door mobilization 24-48 hours before spray instead of twice mobilization door- door (one in two weeks before and a second with 24-48 hours). Then, the introduction of the self-mobilization of chiefs of villages as principal actors for community mobilization, instead of recruit moblizators and paid them for night days.by one-third--makes it more likely that in-country stakeholders will fund IRS as a vector control strategy.
- Coordination with the District Health Authorities allowed them to efficiently leverage IRS activities to increase COVID19 vaccination coverage among the community health workforce.
- Paying community service participants using mobile payment worked well. It will be important to continue this system for the implementation of vector control strategies in the future.

6.3 KEY RECOMMENDATIONS

The project recommends the following:

- To promote sustainability, optimize coverage rates, and increase cost effectiveness in IRS programs:
  - Continue to minimize the duration of IRS campaigns while maintaining high-quality, effective spraying.
  - Encourage the NMCP to work with new IRS communities so that they make in-kind contributions, such as providing operations sites and storage facilities, for the duration of IRS in that area (2-3 years) in return for being protected against malaria. This will lower costs for the project implementation.
  - Continue using the self-mobilization approach: The next IRS implementer should encourage communication and community participation.

Other key recommendations include:

- Have all actors vaccinated against COVID-19 or other emerging threats during future IRS campaigns.
- Involve the Ministry of Woman, Family and Children and share lessons learned about gender inclusion—specifically, inclusion of women in IRS activities—from PMI VectorLink programs in other countries as well as from other projects operating in Côte d'Ivoire.

ANNEX A: MONITORING AND EVALUATION (M&E) PLAN

#	Performance Indicator	Global Project Indicator	Data Source(s) and Reporting Frequency	Disaggregation(s)	Annual Targets and Results									
					Year 1		Year 2		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 targeted for spraying		Project records Annually	Country	NA	NA	NA	NA	56,601		58,695	62,551	62,551	71,474
1.1.3	Number of eligible structures sprayed with IRS[1]		Project records Annually	Country	NA	NA	NA	NA	48,111	53962	49,891	60,496	53,168	70,392
1.1.4	Percentage of total structures targeted for spraying that were sprayed with a residual insecticide (Spray Coverage)		Project records Annually	Country	NA	NA	NA	NA	85%	91,9%	85%	96.70%	85%	98.49%
1.1.5	Number of people protected by IRS [2]		Project records Annually	Country Sex Male sex Female Pregnant women Children <5	NA	NA	NA	NA	170,143 86,111 84,032 2,714 24,245	193,935 96,680 97,255 4,349 30,053	193,935 96,680 97,255 4,349 30,053	201,178 100,817 100,361 5,008 32,068	206,722 103,765 102,957 5,093 32,730	228,431 114,294 114,137 7,119 38,795

#	Performance Indicator	Global Project Indicator	Data Source(s) and Reporting Frequency	Disaggregation(s)	Annual Targets and Results									
					Year 1		Year 2		Year 3 (2020)		Year 4 (2021)		Year 5 (2022)	
					Target	Result	Target	Result	Target	Result	Target	Result	Target	Result
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: Mass distribution	NA	NA	NA	NA	NA	NA	2,815,534 2,815,534	3,074,527 3,074,527		
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										

#	Performance Indicator	Global Project Indicator	Data Source(s) and Reporting Frequency	Disaggregation(s)	Annual Targets and Results									
					Year 1		Year 2		Year 3 (2020)		Year 4 (2021)		Year 5 (2022)	
					Target	Result	Target	Result	Target	Result	Target	Result	Target	Result
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 support VC in target areas		Project Training Records Annually	Country VC Intervention:IRS Sex: Male Sex: Female Job Function	NA	NA	NA	NA	1,250 1,250 875 375 See Table 2	1129 1,129 916 213	1005 1005 703 302 See Table 2	864 864 701 163	1008 1008 706 302 See Table 2	2017 2017 1713 304
1.2.2	Total number of people trained to support VC in target areas with USG funds		Project Training Records Annually	Country VC Intervention Sex: Male Sex: Female Job Function	NA	NA	NA	NA	353 353 247 106 See Table 2	353 353 308 45	358 358 251 107 See Table 2	256 256 230 26	356 356 249 107 See Table 2	349 349 306 43
1.2.3	Number of people trained during the Master (National) Training and/or IRS Training of Trainers[3]		Project Training Records Annually	Country Sex: Male Sex: Female Type of Training: TOT Master Training: Boot Camp	NA	NA	NA	NA	85 74 11 55 30	85 74 11 55 30	35 35 0	67 59 8 67 0	70 70 0	54 49 5 54 0
1.2.4	Total number of people hired to support VC in target areas.		Project Records Annually	Country VC Intervention Sex: Male Sex: Female Job Function	NA	NA	NA	NA	1,078 1,078 755 323 See Table 2	882 882 687 195	800 800 560 240 See Table 2	709 709 566 143	814 814 570 244 See Table 2	490 490 387 103

#	Performance Indicator	Global Project Indicator	Data Source(s) and Reporting Frequency	Disaggregation(s)	Annual Targets and Results									
					Year 1		Year 2		Year 3 (2020)		Year 4 (2021)		Year 5 (2022)	
					Target	Result	Target	Result	Target	Result	Target	Result	Target	Result
1.2.5	Number of VC project training workshops targeting NMCP and other host country staff[4]		Project Training Records Annually	Country T A: Ento T A: Eco T A: M&E T A: Intro IRS	NA	NA	NA	NA	4 1 1 1 1	4 1 1 1 1	4 1 2 1 1	7 1 2 2 2	4 1 2 1 1	3 2 0 1 0
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	NA	NA	NA	NA	12 See Table 2	22	20 See Table 2	23	20 See Table 2	20
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	NA	NA	NA	NA	NA	NA	2	2	0	
1.2.8	Number and percentage of technical assistance requests to support operational routine monitoring systems for continuous ITN distribution completed on time as planned in a given project year	X	Project Records Annually	Country Channel	NA	NA	NA	NA	NA	NA	2	2	0	
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: Male Sex: Female Job Function	NA	NA	NA	NA	1,121 785 336 See Table 2	1,039 854 185	907 635 272 See Table 2	801 642 159	880 616 264 See Table 2	2,008 1,716 292

#	Performance Indicator	Global Project Indicator	Data Source(s) and Reporting Frequency	Disaggregation(s)	Annual Targets and Results									
					Year 1		Year 2		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: Male Sex: Female	NA	NA	NA	NA	74 52 22	55 50 5	36 34 2	36 34 2	36 34 2	36 34 2
1.3.3	Number of adverse reactions to pesticide exposure documented that resulted in a referral for medical care		Incident Report Forms	Country Type of Exposure	NA	NA	NA	NA	0 N/A	0 N/A	0 0	5	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										
1.3.5	Number and percentage of permanent and mobile soak pits inspected and approved prior to IRS campaigns or before first use		Project Records - PSECAs	Country Mobile Soak Permanent Soak	NA	NA	NA	NA	19 2 (11%) 17 (89%)	18 2(11%) 16(89%)	20 0 20 (100%)	21 0 21 (100%)	20 0 20 (100%)	20 0 20(100%)
1.3.6	Number and percentage of storehouses inspected and approved prior to IRS campaigns		Project Records - PSECAs Annually	Country Storehouse Type: Central Storehouse Type: District Storehouse Type: Site	NA	NA	NA	NA	22 1 2 19	22 1 2 19	23 1 2 20	23 1 2 20	23 1 2 20	23 1 2 20
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: Female (%) Job Function	NA	NA	NA	NA	339 30% See Table 2	195 19%	240 30% See Table 2	143 20%	246 30% See Table 2	103 21%

#	Performance Indicator	Global Project Indicator	Data Source(s) and Reporting Frequency	Disaggregation(s)	Annual Targets and Results									
					Year 1		Year 2		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: Female (%) VC Intervention: IRS Job Function	NA	NA	NA	NA	52 52 See Table 2	29 14.87% 29	38 30% 38 See Table 2	18 13% 18	38 30% 38 See Table 2	18 17% 18
1.4.3	Number and percentage of trainees (permanent and seasonal) who have completed gender awareness training		Project Records Annually	Country Sex: Male (# and %) Sex: Female (# and %) Job Function	NA	NA	NA	NA	1212 827 355 See Table 2	1111 931 180	949 664 285 See Table 2	851 717 (84%) 134 (16%)	987 691 296 See Table 2	2030 1762 (87%) 268 (13%)
1.4.4	Number and percentage of women in senior leadership roles in VectorLink country offices	X	Project Records Annually	Country Sex (# and %)										
1.5	**Implement and Support SBCC and Mobilization Activities**													
1.5.1	Number of radio spots and talk shows aired		Project Records	Country VC Intervention: IRS Media: Radio Spot	NA	NA	NA	NA	392 392 392	430 430 430	430 430 430	442 442 442	442 442 442	358 358 358
1.5.2	Number of print materials distributed to or targeted at beneficiaries		Project Records Annually	Country VC Intervention:IRS	NA	NA	NA	NA	6486 6486	2371 2371	4272 4272	3417 3417	0 0	4533 4533
1.5.3	Number of people reached with vector control and/or SBCC messages via door-to-door messaging[5]		Project Records Annually	Country Sex: Male Sex: Female	NA	NA	NA	NA	100,885 51,059 49,826	84434 39262 45172	104,248 52,235 52,013	89,944 42,770 47,174	71,955 34,216 37,739	95,919 45,555 50,364

#	Performance Indicator	Global Project Indicator	Data Source(s) and Reporting Frequency	Disaggregation(s)	Annual Targets and Results									
					Year 1		Year 2		Year 3 (2020)		Year 4 (2021)		Year 5 (2022)	
					Target	Result	Target	Result	Target	Result	Target	Result	Target	Result
Objective 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 (vector species, distribution, seasonality, feeding time, and location)		Entomological Reports Annually	Country Entomology Only IRS	4 4 0	4 4 0	4 4 0	4 4 0	4 2 2	4 2 2	4 2 2	4 2 2	4 2 2	4 2 2
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 Entomology Only IRS	4 4 0	4 4 0	4 4 0	4 4 0	4 2 2	4 2 2	4 2 2	4 2 2	4 2 2	4 (100%) 2 (100%) 2 (100%)
2.1.3	Number and percentage of vector bionomics monitoring sites measuring the following all advanced entomological indicators: sporozoite rates and entomological inoculation rates		Entomological Reports Annually	Country Entomology Only IRS	4 4 0	4 4 0	4 4 0	4 4 0	4 2 2	4 2 2	4 2 2	4 2 2	4 2 2	4 (100%) 2 (100%) 2 (100%)
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 Entomology Only IRS	10 10 0	10 10 0	19 19 0	16 16 0	18 16 2	18 16 2	18 16 2	18 16 2	18 16 2	18 (100%) 16 (100%) 2 (100%)

#	Performance Indicator	Global Project Indicator	Data Source(s) and Reporting Frequency	Disaggregation(s)	Annual Targets and Results									
					Year 1		Year 2		Year 3 (2020)		Year 4 (2021)		Year 5 (2022)	
					Target	Result	Target	Result	Target	Result	Target	Result	Target	Result
2.1.5	Number and percentage of houses in which WHO cone bioassays were conducted within two weeks of spraying with greater than 98% test mortality recorded for IRS countries		Entomological Reports Annually	Country Insecticide Type: Fludora Fusion Insecticide Type: Sumishield	N/A	N/A	N/A	N/A	18 (100%) 9 9	18 9 9	18 9 9	16 8 8	18 9 9	21 (100%) 12 (100%) 9 (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: Fludora Fusion Insecticide Type: Sumishield	N/A	N/A	N/A	N/A	18 (100%) 9 9	18 NA NA	18 9 9	4 2 2	18 9 9	6 (33.33%) 3 (33.33%) 3 (33.33%)
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										
2.1.8	Number of people trained (VectorLink and non VectorLink staff) in entomological monitoring		Project Records Annually	Country Sex: Male Sex: Female	17 13 (76%) 4 (24%)	17 13 (76%) 4 (24%)	19 15 (79%) 4 (21%)	19 15 (79%) 4 (21%)	20 15 (75%) 5 (25%)	35 22 (63%) 13 (37%)	20 14 (70%) 6 (30%)	58 44 (76%) 14 (24%)	20 14 (70%) 6 (30%)	53 52 (98%) 1 (2%)
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	NA	NA	NA	NA	NA	NA	2	2

#	Performance Indicator	Global Project Indicator	Data Source(s) and Reporting Frequency	Disaggregation(s)	Annual Targets and Results									
					Year 1		Year 2		Year 3 (2020)		Year 4 (2021)		Year 5 (2022)	
					Target	Result	Target	Result	Target	Result	Target	Result	Target	Result
2.1.10	Number of nets in which WHO cone bioassays were conducted to evaluate bio-efficacy of bed nets		Entomological Records Annually	Country	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
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 vector control decision making	X	Project Records Annually	Country										
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	NA	NA	NA	NA	12 See Table 2 See Table 2	0 See Table 2 See Table 2	12 See Table 2 See Table 2	0 0	12 See Table 2 See Table 2	7

#	Performance Indicator	Global Project Indicator	Data Source(s) and Reporting Frequency	Disaggregation(s)	Annual Targets and Results									
					Year 1		Year 2		Year 3 (2020)		Year 4 (2021)		Year 5 (2022)	
					Target	Result	Target	Result	Target	Result	Target	Result	Target	Result
2.3.2	Number and percent of targeted individuals that report using new analytical tools and/or skills in their planning, resourcing, implementation, or measurement activities		Capacity Assessments Thrice Over Project Life	Country Job Function Organization	NA	NA	NA	NA	0 See Table 2 See Table 2	0 See Table 2 See Table 2	0 See Table 2 See Table 2	0	0 See Table 2 See Table 2	0
Objective 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 procurements received on-time to allow for the initiation of spray operations as scheduled		Procurement Records	Country Insecticide Type: Fludora Fusion Insecticide Type: Sumishield	NA	NA	NA	NA	2 1 1	2 1 1	1 1 0	1 1 0	1 1 0	3 2 1
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										

#	Performance Indicator	Global Project Indicator	Data Source(s) and Reporting Frequency	Disaggregation(s)	Annual Targets and Results									
					Year 1		Year 2		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: IRS Sex: Male Sex: Female Job Function	NA	NA	NA	NA	24 24 17 7 See Table 2	25 25 15 10	25 25 17 8 See Table 2	25 25 21 4	25 25 17 8 See Table 2	25 25 19 6
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	NA	NA	NA	NA	19;100%	19	20	20	20	20
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										
Objective 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	NA	NA	NA	NA	0	0	0	1	0	0
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	X	Project Records Annually	Country Technical Area										

#	Performance Indicator	Global Project Indicator	Data Source(s) and Reporting Frequency	Disaggregation(s)	Annual Targets and Results									
					Year 1		Year 2		Year 3 (2020)		Year 4 (2021)		Year 5 (2022)	
					Target	Result	Target	Result	Target	Result	Target	Result	Target	Result
4.2.2	international institutions for global reporting on the Vector Learning Exchange Number of individual members who use the Vector Learning Exchange	X	Project Records Annually	N/A										
4.2.3	Number of symposia and/or presentations submitted to and accepted at global conferences		Project Records = Annually	Country Technical Area: Entomology PAMCA, ASTHM	0	0	0	1 1	2 2	1 1	2 2	1 1 1	2 2	0 0
4.2.4	Number of success stories written or videos produced and shared on the VectorLink project website		Project Records = Annually	Country	0	0	0	0	1	3	1	0	1	1
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 guidance documents		Project Records Annually	Country Technical Area: M&E Technical Area: Entomology All area (Strategic Plan)	0	0	0	0	2	4 1 2 1	3 1 1 1	3 1 1 1	3 1 1 1	2 0 2

#	Performance Indicator	Global Project Indicator	Data Source(s) and Reporting Frequency	Disaggregation(s)	Annual Targets and Results									
					Year 1		Year 2		Year 3 (2020)		Year 4 (2021)		Year 5 (2022)	
					Target	Result	Target	Result	Target	Result	Target	Result	Target	Result
4.3	**Develop and deploy cost-savings approaches**													
4.3.1	Number of innovative or novel approaches implemented to achieve cost savings in IRS and integrated malaria vector control programs		Project Records Annually	Country Type of Innovation: Transportation Type of Innovation: Local procurment Type of Innovation: self-mobilization	NA	NA	NA	NA	1	2 1 1	2	3	3	1 1
4.3.2	Number of cost effectiveness assessments of existing approaches in the implementation of IRS and integrated malaria vector control programs		Project Records Annually	Country VC Intervention	NA	NA	NA	NA	NA	NA	NA	N/A	NA	4
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	NA	NA	NA	NA	0	2	2	2	2	2

ANNEX B: ENVIRONMENTAL MITIGATION AND MONITORING REPORT

Mitigation Measure	Status of Mitigation Measures	Outstanding Issues Relating to Required Conditions	Remarks
1. Research and Development 1. Implement laboratory environmental, health, and safety (EHS) manuals with standard operating procedures (SOPs), or use existing SOPs, for laboratory operations in accordance with country-specific compliance mechanisms.	Entomological activities are entrusted to the CSRS in Abidjan (the center complies with international guidelines) as a subcontractor of PMI VectorLink.	No outstanding issues	
2. Implement SOPs for the safe storage, transport, and use of equipment, chemical reagents, insecticides, and supplies in conformance with international best practices (e.g., WHO, FAO) and host-country requirements.		No outstanding issues	
3. Provide training to workers on the approved SOPs or Waste Management Plan (WMP) developed for properly handling and disposing of wastes.		No outstanding issues	
II. Small-Scale Construction 1. Obtain all needed authorizations prior to construction: permits, environmental and social impact assessments, etc.	• VectorLink supported the rehabilitation of two partner laboratories (animal shelter at CEMV and insectary at INHP) in implementing entomological activities in accordance with the EHS manual/ SOPs • Permits on file	INHP insectary rehabilitated	
2. Retain competent, licensed professionals to design and supervise construction.	Construction contracts are in place for engaged professionals and reflect USAID requirements for small-scale construction	No outstanding issues	
3. Establish EHS obligations in all contracts.	• EHS manual / SOPs in all contracts.	No outstanding issues	
4. Complete a site emergency action plan.			
5. Provide safety training to all workers using construction equipment.	Staff were briefed on how activities relate to SOPs.	No outstanding issues	
6. Identify closest health care facility to handle injuries.			
7. Asbestos, lead-based paints, and other toxic materials will not be used under any circumstances. If the presence of asbestos is suspected in a facility to be renovated, the facility must be tested before rehabilitation works begins. If asbestos is present, the work must be carried out in conformity with host-country requirements and with guidance to be provided by the Implementing Partner. All results of the testing for asbestos will be communicated to the contracting officer's representative.			

Mitigation Measure	Status of Mitigation Measures	Outstanding Issues Relating to Required Conditions	Remarks
8 Develop and follow a WMP. Identify authorized recycling or disposal facilities before generating waste.	A WMP is in place and is being followed to identify and characterize all waste streams from the project with the proposed final disposal option.	No outstanding issues	
9. Minimize the generation of waste by: ✓ Correctly assessing material needs (not over-buying) ✓ Reducing amount of packaging used by suppliers Reuse materials on site, such as using discarded materials to level ground and fill trenches.			
10. Designate secure on-site waste storage facilities.	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.	No outstanding issues	
11. Ensure all workers are trained and dispose of wastes properly.			
12. Complete and track hazardous waste manifests for all shipments			
13. Source all construction material from an ecologically safe provider.			
14. Contractor must provide, and all workers must use personal protective equipment (PPE) such as hardhats, footwear, dust masks, safety glasses, and reflective vests, as needed.	Staff were briefed on how activities relate to SOPs.	No outstanding issues	
15. Ensure first aid and spill clean-up kits are easily available.	SOPs implemented.	No outstanding issues	
16. Contractors must comply with the "Small-Scale Construction" chapter of the USAID Sector Environmental Guidelines (https://www.usaid.gov/environmental-procedures/sectoral-environmental-social-best-practices/seg-construction/pdf)			
17. Contractor will provide drinking water, a latrine, and a hand-washing station to workers.			
18.Contractors will arrange working hours to minimize disruption to the community.			
19. If needed, construct drainage canals and infiltration pits for management of storm water and prevention of soil erosion.			
20. After construction, ensure leftover materials have been properly disposed of.			
III. Vector Control **A. Indoor Residual Spraying** 1a. Insecticide selection for any USAID-supported malaria program is subject to the criteria listed in the USAID Programmatic Environmental Assessment, country Supplemental Environmental Assessment (SEAs), and host-country requirements.	All insecticides used for the campaign met the USAID Programmatic Environmental Assessment selection criteria. The SEA, which was approved in 2020, provides nationwide coverage for the period 2020–2024. The Ministry of Environment and Sustainable Development endorsed two classes of insecticides for IRS use.	No outstanding issues	

Mitigation Measure	Status of Mitigation Measures	Outstanding Issues Relating to Required Conditions	Remarks
1b. Maintain procurement and inventory logs.	- Registers and other logistical tools were available in all stores. - Equipment and material contained in the storage warehouse and on the operational site were regularly inventoried. Logistics tools were checked daily and weekly. ✓ 2020: Insecticides type: Fludora Fusion and SumiShield. Total sachets procured = 50,111. Sachets used = 21,815 and Sachets leftover =28,280 ✓ 2021: Insecticides type: Fludora Fusion and SumiShield. Total sachets procured = 00, the leftover from 2020 was used for 2021. Sachets used = 23,365 (including 488 sachets used for non-residential structures) and Sachets leftover =4,915 (SS) ✓ 2022: Insecticides type: Fludora Fusion and SumiShield. Total sachets procured = 21,068 in additional to the residual stock from 2021(4,915) giving a total of 25,983. Sachets used = 25,107 (including 289 sachets used for non-residential structures) and Sachets leftover =876 (220 of SS and 656 of FF)	No outstanding issues	
1c. Ensure storage facility and PPE are appropriate for the active ingredient used and in accordance with approved SOPs.	Insecticide storage stores: - Are closed with a double lock. - Have waterproof floors and roofs. - Are equipped with a thermo hygrometer to monitor physical parameters (such as temperature and humidity). - Are equipped with spill and first aid kits. - Are guarded 24 hours a day by security guards. - Are on pallets.	No outstanding issues	
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/WMP).	Before insecticides were distributed to facilities, the following requirements were met: - Rehabilitated existing facilities according to BMP standards. - Built non-existent installations according to BMP standards. - Equipped all installations with the necessary equipment and material for proper operation of the IRS. All stores were authorized to deploy insecticide before the spray campaign started (i.e., all needed commodities were in place before the insecticide was deployed).	No outstanding issues	
2a. Inspect and certify vehicles used for insecticide or team transport prior to contract.	36 three-wheeler ATV and 15 vehicles were inspected and certified.	No outstanding issues	
2b. Train drivers.	51 drivers were trained on SOPs and safe transport of insecticides.	No outstanding issues	
2c. Ensure availability of cell phone, PPE, and spill kits during insecticide transportation.	- All drivers had their own cell phone and PPE (boots, gloves, mask). - All insecticide transport vehicles had a spill kit.	No outstanding issues	
2d. Do initial and 30-day pregnancy testing for female candidates for jobs with potential insecticide contact.	36 applicants for positions with potential contact with the insecticide had two pregnancy tests within 30 days.	No outstanding issues	
2e. Administer a health test to ensure all spray team members' fitness for duty.	All 289 spray team members underwent a medical examination to ensure their physical fitness.	No outstanding issues	

Mitigation Measure	Status of Mitigation Measures	Outstanding Issues Relating to Required Conditions	Remarks
2f. Procure services of, distribute, and train all workers with potential insecticide contact on the use of PPE.	- Needed PPE was available to all applicators. - All spray operators were trained on the use (wearing / removing) of PPE. - 105 red flags were noted in relation to PPE: 43 through the end-of-day clean-up supervision; 44 through the morning mobilization supervision; 20 through the homeowner preparation and spray operator performance supervision.	No outstanding issues	
2g. Train spray operators on mixing of insecticides and proper use and maintenance of application equipment.	All applicators were trained on: ➢ Insecticide mixing protocol. ➢ PPE and pump maintenance. - 44 red flags were noted through morning mobilization supervision. - 36 red flags were noted through homeowner preparation and spray operator performance supervision. - 43 red flags were noted through end-of-day supervision.	No outstanding issues	
2h. Provide adequate facilities and supplies for end-of-day clean-up.	The wash area of each operations site was equipped with 7 drums and 4 basins of water needed during the end-of-day cleaning. 0 red flags were noted through end-of-day supervision.	No outstanding issues	
2i. Enforce application and clean-up procedures.	Supervision of end-of-day clean-up by the team leader, pump technician, and supervisor. 0 red flags were noted through end-of-day supervision.	No outstanding issues	
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.	- 362 mobilizers were recruited and trained to raise awareness among beneficiaries. - 03 short radio spots and messages (in French and the two main local languages in the respective provinces: Koulango and Lobi in Nassian and Malinké and Baoulé in Sakoussou). - 06 debates and (interactive) discussion shows.	No outstanding issues No outstanding issues	
3b. Ensure health facility staff are aware of insecticide poisoning management.	- 54 health center staff were trained in the management of poisoning cases linked to insecticides including 5 women.	No outstanding issues	
4a. Storage facilities and transportation vehicles must be physically secured to prevent theft.	- All insecticide stores have a double lock. - Security guards were recruited and trained on security measures for IRS facilities. - Access to storage warehouses was limited to storekeepers, spray operators, and supervisors.	No outstanding issues	
4b. Maintain records of all insecticide receipts, issuance, and return of empty containers.	- Chain-of-custody tools were available in all stores and warehouses. - Stock cards and stocks were monitored using the storekeeper's performance inspection form. - Out of 215 supervisions, 07 red flags were noted through storekeeper's performance supervision.	No outstanding issues	
4c. Conduct analysis comparing number of houses treated vs. number of containers used.	- Nassian: 3.3 structures treated / sachet of insecticide. - Sakassou: 2.5 structures treated / sachet of insecticide.	No outstanding issues	
4d. Examine houses treated to confirm application.	- 1,724 household preparation and spraying techniques forms were completed during supervision. - 3,311 DCV forms were completed	No outstanding issues	
4e. Perform physical inventory counts during the application season.	- Weekly inventory of the store was completed by the assistant logistician. - 7,215 storekeeper performance form were completed.	No outstanding issues	

Mitigation Measure	Status of Mitigation Measures	Outstanding Issues Relating to Required Conditions	Remarks
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 PPE to be worn when handling the barrel.	NA	No outstanding issues	
5b. Train applicators on the SEA operational requirements, SOPs, PMI BMPs, and approved WMP developed for the safe and effective storage, distribution, application, and disposal of insecticides.	- All appropriate teaching modules were available. - 289 spray operators were trained on the SEA operational requirements, SOPs, PMI BMPs, and approved WMP.	No outstanding issues	
5c. Ensure application equipment and PPE are appropriate for the active ingredient used and in accordance with approved SOPs, and maintain equipment to avoid leaks.	NA	No outstanding issues	
5d. Maintain application equipment.	- Triple rinsing of pumps was performed at the end of the spray day. - Daily and weekly maintenance of the pumps was performed. - Gloves, helmets and visors, boots, and mufflers were cleaned each day. - Applicator outfits were washed and maintained each day.	No outstanding issues	
5e. No application of insecticides within 30 yards of beekeeping sites.	Spraying of insecticide was only done in eligible structures far from protected areas:	No outstanding issues	
6a. Handling, treatment, and disposal of nonhazardous (general waste) and hazardous wastes must be in accordance with the approved WMP/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.	Each type of waste was collected and packaged in labeled bin bags. - Contaminated waste (empty insecticide sachets, used mufflers, used latex gloves, and used batteries) was stored in the insecticide store on the operations site. - Uncontaminated waste was stored outside the insecticide store on the operations site. - Waste generated during the IRS campaign was transferred from the operations site to the district store and then from the district store to the warehouse. - All contaminated waste as well as non-recyclable waste was transferred from the two districts to RMG Côte d'Ivoire SA for incineration. - Recyclable plastic waste was transferred to Conceptos Plasticos for the manufacture of bricks.	No outstanding issues	
6b. Choose sites for disposal of liquid wastes, including fixed and mobile soak pit sites according to PMI BMPs.	21 sites (including the central warehouse in Bouaké) were chosen for the construction of washing areas with a fixed soak pit.	No outstanding issues	
6c. Construct fixed and mobile soak pits with charcoal according to the BMPs to adsorb insecticide from rinse water.	21 washing areas with a fixed soak pit (including one at the central warehouse in Bouaké) were built or rehabilitated according to PMIs BMPs for the management of liquid waste.	No outstanding issues	
6d. Maintain soak pits as necessary during season.	- Wastewater evacuation routes were regularly monitored to avoid their being obstructed by mud or other material. - The wash and fixed soak pit areas were kept clean.	No outstanding issues	

Mitigation Measure	Status of Mitigation Measures	Outstanding Issues Relating to Required Conditions	Remarks
6e. Monitor waste storage and management during campaign.	- All wastes were collected and segregated for each type of disposal daily in labeled bin bags. - Contaminated wastes (empty insecticide sachets, and used mufflers, latex gloves, and batteries) were stored in the insecticide store on the operations site. Uncontaminated wastes were stored outside the insecticide store on the operations site.	No outstanding issues	
6f. Monitor disposal procedures post-campaign.	- The wastes generated during the IRS campaign were transferred from the operations site to the district store and then from the district store to the warehouse. - All contaminated wastes as well as non-recyclable wastes were transferred from the two districts to RMG for incineration. The incineration of …….. kilograms of waste has been completed. - kilograms of recyclable plastic waste were transferred to Conceptos Plasticos for the manufacture of bricks.	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.	RMG incinerated all wastes at a temperature between 1100ºC and 1200ºC with a combustion gas residence time of 2 seconds.	No outstanding issues	
7b. Country-level USAID environmental compliance documentation must contain guidance on proper disposal of wastes	- A WMP for solid wastes was drafted and shared with all stakeholders. - All spray teams were trained on the triple-rinsing protocol for pumps and cleaning of PPE. - An agreement was signed with RMG for the incineration of contaminated solid waste and non-recyclable solid waste. - An agreement was signed with Conceptos Plasticos for the recycling of recyclable plastic waste. - Incineration of non-contaminated waste and non-recyclable waste was reported. - Recycling report of recyclable plastic waste.	No outstanding issues	
B. Testing of ITNs Store ITNs only in storerooms secured with sturdy doors, locks, and barred windows.	N/A	No outstanding issues	
C. Distribution of ITNs Where there is evidence of misuse for fishing, assess the extent of misuse and collaborate across sectors (ministries of Health, Environment, and Agriculture) to develop a sustainable, locally relevant solution	N/A	No outstanding issues	
Store ITNs in dry, ventilated facilities.	N/A	No outstanding issues	

Mitigation Measure	Status of Mitigation Measures	Outstanding Issues Relating to Required Conditions	Remarks
Store in a secure facility to prevent theft or unauthorized access. Post a guard or use barred windows as needed.	N/A	No outstanding issues	
Do not store long-lasting insecticidal nets (LLINs) with food, feed, or potable water supplies.	N/A	No outstanding issues	
Provide worker training on the proper handling of LLINs.	N/A	No outstanding issues	
Ensure that Social Behavior Change Communication materials and outreach activities are coordinated with ITN distribution activities during campaigns and include guidelines on how to properly wash and maintain LLINs (e.g., discourage disposal of wash water in sensitive ecosystems, discourage washing and rinsing of LLINs in water bodies).	N/A	No outstanding issues	
Ensure that Social Behavior Change Communication messages inform campaign distributors and local communities about the potential harm to human health and the environment if bags and baling materials are reused; support development of a communication plan that provides messages on best practices for handling and disposing of bags and baling materials.	N/A	No outstanding issues	