



U.S. PRESIDENT'S MALARIA INITIATIVE



THE PMI VECTORLINK PROJECT RWANDA

2020 END OF SPRAY REPORT

SPRAY CAMPAIGN:
AUGUST 24–SEPTEMBER 18, 2020

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PMI VECTORLINK RWANDA

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ACRONYMS

BMP	best management practices
CHW	community health worker
ECO	Environmental Compliance Officer
IEC	information, education and communication
IRS	indoor residual spraying
M&E	monitoring and evaluation
MOH	Ministry of Health
MOPDD	Malaria and Other Parasitic Diseases Division
PMI	President’s Malaria Initiative
PNP	plastered and not painted
PP	plastered and painted
PPE	personal protective equipment
PSECA	Pre-Season Environmental Compliance Assessment
REMA	Rwanda Environment Management Authority
SEA	Supplemental Environmental Assessment
TOT	training of trainers
USAID	United States Agency for International Development
WHO	World Health Organization

EXECUTIVE SUMMARY

Abt Associates implements indoor residual spraying (IRS) in Rwanda through the U.S. President’s Malaria Initiative (PMI) VectorLink Project, funded by the United States Agency for International Development (USAID). The objective of PMI VectorLink is to support the planning and implementation of IRS programs and other proven life-saving malaria vector control interventions. To achieve this objective, VectorLink Rwanda conducted IRS from August 24 through September 18, 2020, in Rwanda’s Kirehe, Ngoma, and Nyagatare districts. The project targeted 312,362 structures in 40 sectors in the three districts (12 in Kirehe, 14 in Nyagatare, and 14 in Ngoma) for blanket coverage using Fludora® Fusion insecticide (clothianidin/deltamethrin). The spray campaign lasted 20 operational days in each district (see Table ES-1). At the request of the Government of Rwanda, VectorLink Rwanda also sprayed Mahama Refugee Camp in Kirehe district from September 16 through 17, 2020; the project targeted 7,410 structures in the camp. The Ministry of Health (MOH) provided the insecticide and VectorLink Rwanda covered all operational costs, including data entry management.

Table ES-1: 2020 IRS Campaign Summary: Kirehe, Nyagatare and Ngoma

Number of districts covered by PMI-supported IRS	3 districts (Kirehe, Nyagatare and Ngoma)
Insecticide	Fludora® Fusion
Number of structures sprayed by PMI-supported IRS	327,704
Number of structures found by PMI-supported IRS	328,676
Spray coverage	99.7%
Population protected by PMI-supported IRS	1,295,240 (17,863 pregnant women; 175,504 children under 5)
Dates of PMI-supported IRS campaign	August 24–September 18, 2020 (Kirehe, Ngoma and Nyagatare)
Length of campaign	20 days
Number of people trained with U.S. government funds to deliver IRS*	2,882 (1,440 males and 1,442 females)

*Based on the PMI indicator definition, this indicator includes only spray operators, team leaders, and supervisors. However, in Rwanda, the sector and district Information, Education and Communication (IEC) are included, since they participate in the training of trainers (TOT) and provide some supervision during the spray campaign.

Table ES-2: 2020 IRS Campaign Summary: Mahama Refugee Camp

Number of districts covered by PMI-supported IRS	1 (Kirehe; specifically, Mahama Refugee Camp)
Insecticide	Fludora [®] Fusion
Number of structures sprayed by PMI-supported IRS	7,098
Number of structures found by PMI-supported IRS	7,098
Spray coverage	100.0%
Population protected by PMI-supported IRS	60,416 (1,605 pregnant women and 12,307 children under 5)
Dates of PMI-supported IRS campaign	September 16–17, 2020
Length of campaign	Two days
Number of people trained with USG funds to deliver IRS	N/A*

*The project did not need to engage additional personnel to spray the Mahama Refugee Camp, as it used workers trained to support the Kirehe spray campaign. The Rwanda government provided the insecticide used in Mahama camp.

Table ES-3: 2020 IRS Campaign Summary by District

District	Structures Found	Structures Sprayed	Males Protected	Females Protected	Pregnant Women Protected	Children Protected
Kirehe*	95,168	94,827	179,931	194,962	4,762	49,266
Nyagatare	137,673	137,196	261,165	279,023	8,055	77,615
Ngoma	95,835	95,681	181,755	198,404	5,046	48,623
Total	328,676	327,704	622,851	672,389	17,863	175,504

*The results for Kirehe do not include Mahama Refugee Camp; those results are in Table ES-2.

Below are the key project achievements and highlights.

- The project sprayed 327,704 out of 328,676 structures that spray operators found, accounting for a coverage rate of 99.7%. Included within this total are 39 dormitories in seven special structures in Kirehe, Nyagatare, and Ngoma, protecting 262 people. Special sleeping structures included transit centers for people in route to refugee camps or prisons, police stations, and prisons.
- A data collection verification exercise was conducted in all three districts and physical structure verification was undertaken in two affected sectors in Nyagatare district after the project discovered data falsification in these two sectors. The project did not find widespread data falsification based on these additional verification activities.
- For the first time, the team was able to spray the three districts at the same time. This arrangement of spraying three districts simultaneously provided an opportunity to conduct one spray campaign and reduce operational costs.
- IRS operations were completed during the COVID-19 global pandemic in adherence with PMI VectorLink’s operating standards to reduce the risk of COVID-19 in communities. These mitigation

measures included: physical distancing of at least 6 ft. (2m), mandatory face coverings, and handwashing stations at all 48 operations sites to promote frequent handwashing, hand sanitizers made available to spray teams and other seasonal staff, recording daily body temperature, and daily vehicle disinfection across all sites. Also, the project reduced the numbers of people who can ride in the same vehicle together, to promote physical distancing, while also mandating personal protective equipment (PPE) use during transport.

- In total, 1,295,240 people were protected, including 175,504 children under 5 and 17,863 pregnant women. The following is the breakdown of people protected by district, (1) Nyagatare 540,188 (2) Kirehe 374,893 and (3) Ngoma 380,159.
- In Mahama Refugee Camp, 60,416 people were protected, including 12,307 (20.4%) children under 5 and 1,605 (2.6%) pregnant women.
- The project trained a total of 3,585 individuals to implement IRS activities in the three districts. For indicator 1.2.2, which per the PMI definition only includes those directly responsible for spray (in this case Spray Operators, Team Leaders, Supervisors, Sector/District IECs, and Sector Coordinators) 2,882 were trained with USG funds. Of this number, 2,239 (1,108 males and 1,131 females) were spray operators, and 436 (219 males and 217 females) were team leaders. The breakdown of trainees by gender shows that 50.4% of the spray operators and team leaders trained were female. Overall, 47.4% (n=1,756) of all IRS personnel trained for the 2020 campaign were female.
- The teams used 238,026 sachets of Fludora[®] Fusion insecticide to spray the 327,704 structures in Kirehe, Nyagatare, and Ngoma, a utilization ratio of approximately 1:1.4 (sachets to structures sprayed).
- The project incinerated all IRS contaminated waste (3,750 kg), including 49,630 used masks and 238,026 empty sachets, in the spray areas' respective district hospitals incinerators. A total of 50 helmets and assorted plastic items (damaged barrels, jerry cans, and basins) were sent to Rotassairwa recycling plant. The project donated 2,282 uncontaminated cardboard boxes to Cards from Africa Company in Samuduha; and disposed of e-wastes of 5,122 dry cell batteries at the Enviroserve Rwanda Green Park. Other non-contaminated wastes were disposed of at the Rwanda E-waste recycling facility at Bugesera, and at the Nduba landfill dumping site.
- The spraying quality assessment using Kisumu strain results showed that 100% of mosquitoes exposed to all structure and surface types were killed after 24 hours' holding time, except in Gatore and Nyamugali on plastered and painted (PP) and plastered and not painted (PNP) structures, where the mortality was 94% and 86% respectively at 24 hours. However, it was 100% after 48 hours for Gatore and 72 hours for Nyamugali.
- With wild *Anopheles* mosquitoes, results showed that the mortality rate 24 hours post-exposure ranged between 79% and 100%, but the mortality reached 100% in all sites on all types of walls at 72 hours post-exposure.
- The fumigant effect varied between 76%–100%, 84%–100%, and 100% after 24, 48, and 72 hours' holding time respectively for Kisumu strain. For wild *Anopheles* mosquitoes, the fumigant effect varied between 60% and 100%, 90% and 100%, and 100% after 24, 48 and 72 hours holding time, respectively.

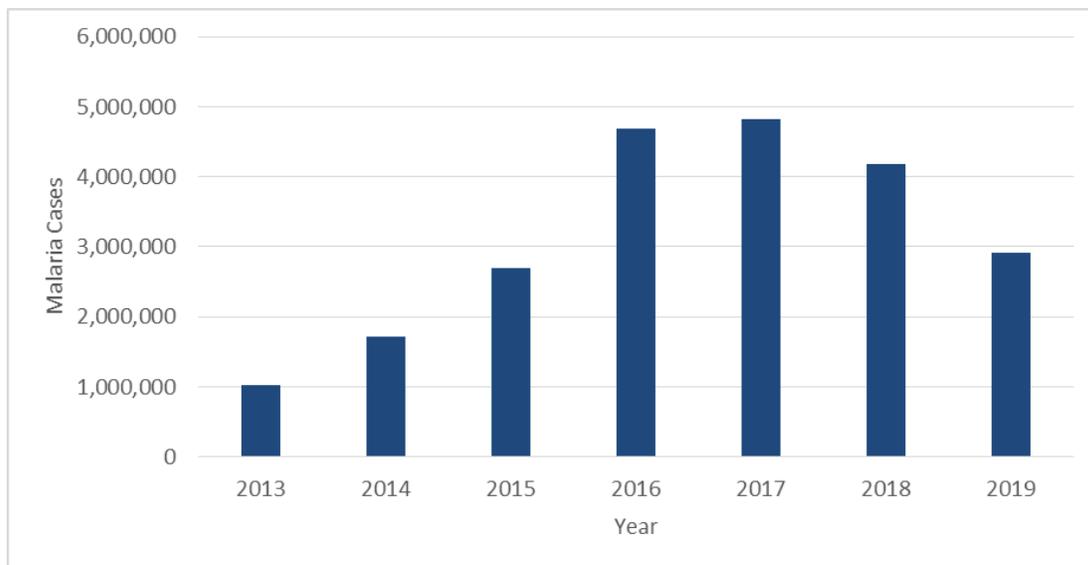
I. COUNTRY BACKGROUND

Rwanda’s entire population of approximately 12.63 million¹ is at risk of malaria, including an estimated 1.8 million children under 5 and 450,000 pregnant women.² In the fight against malaria, Rwanda has significantly reduced the malaria burden. In 2005, malaria was the primary killer of children under 5. By 2008, malaria prevalence in that age group had decreased by more than 50%. From 2008 to 2011, malaria moved from third to eleventh place as the cause of death of children under 5.

Nevertheless, malaria incidence overall increased from 1,014,500 reported cases in 2013 to 4,739,896 in 2017, followed by a decline in 2018 (Figure 1). The increase in malaria cases was observed in all provinces, with the largest increases recorded in the Eastern and Southern provinces.³ The Rwanda Bio-Medical Center/Malaria and Other Parasitic Diseases Division (MOPDD) of the Rwanda MOH therefore chose to target malaria control interventions nationally, with certain interventions focused on high-prevalence areas, as articulated in the Rwanda Strategic Plan for Insecticide Resistance Management in Malaria Vectors (2020–2024) and the Rwanda Malaria Strategic Plan 2020–2024.

Rwanda has implemented IRS as one of its malaria control strategies since 2007. Declining malaria incidence since 2008 in some districts prompted adjustments from blanket IRS coverage to targeted spraying in high-risk areas. Over time, the Rwanda Bio-Medical Center/MOPDD in collaboration with PMI reverted back to blanket coverage because of increases in malaria cases.

Figure 1: Malaria Cases in Rwanda Health Facilities and Community, 2013–2019⁴



1. <http://www.worldometers.info/world-population/rwanda-population/>

2. Rwanda Malaria strategic plan 2020- 2024 (May, 2020)

3. Rwanda Extended National Strategic Plan 2013–2020.

4. Data for 2019 include only January – September. Data for other years shown are for the entire calendar year.

PMI has supported 20 rounds of spray campaigns since IRS started in Rwanda. In the August-September 2020 spray campaign, VectorLink Rwanda sprayed three districts, Kirehe (12 sectors), Nyagatare (14 sectors), and Ngoma (14 sectors), using Fludora® Fusion. A total of 312,362 structures were targeted for spraying. Spray campaigns implemented by VectorLink Rwanda since 2012 are summarized in Table 1.

Table 1: PMI-Supported Campaigns Since 2012

Year	Month	Number of Districts	Structures Sprayed	Population Protected	Insecticide Used
2012	Aug/Sep	3	236,610	1,025,181	Pyrethroid/deltamethrin
2013	Feb/Mar	3	121,154	522,315	Pyrethroid/deltamethrin
	Sep/Oct	3	224,708	957,027	Pyrethroid/deltamethrin
2014	Feb/Mar	3	123,919	512,789	Carbamate/bendiocarb
	Sep/Oct	3	173,086	705,048	Carbamate/bendiocarb
2015	Feb/Mar	2	127,150	517,194	Carbamate/bendiocarb
	Sep/Oct	4	215,981	889,326	Carbamate/bendiocarb
2016	Feb/Mar	2	147,947	618,696	Carbamate/bendiocarb
	Sep/Oct	2	198,970	812,714	Organophosphate/Actellic 300CS
2017	Sep/Nov	3	231,258	919,735	Organophosphate/Actellic 300CS
2018	Sep/Oct	2	214,802*	894,098*	Organophosphate/Actellic 300CS
2019	September	2	221,712*	915,034*	Fludora® Fusion
2020	Jan/Feb	1	92,805	373,918	Fludora® Fusion
2020	Aug/Sept	3	334,802*	1,355,656*	Fludora® Fusion

*The numbers for the September 2018, 2019, and second 2020 campaign include the sprayed structures and population protected in Mahama Refugee Camp.

2. IMPLEMENTATION OF IRS ACTIVITIES

2.1 IRS PLANNING AND PARTNER COLLABORATION

VectorLink Rwanda in collaboration with the MOPDD and PMI designated three districts (Kirehe, Ngoma and Nyagatare) for the district-wide IRS campaign funded by PMI (Figure 2) in August–September 2020. The initial selection was based on the malaria burden reported in epidemiological data from health facilities. The Government of Rwanda has committed to sustaining IRS in these districts in order to maintain the reductions seen following previous IRS campaigns. VectorLink Rwanda targeted 312,362 structures for spraying, which would protect a total population of 1,239,717 (Table 2). A request to spray Mahama Refugee Camp was later made to VectorLink Rwanda, and the project targeted 7,410 structures with 59,441 residents.

Figure 2: Map of Rwanda Showing IRS Target Districts and ITN Distribution

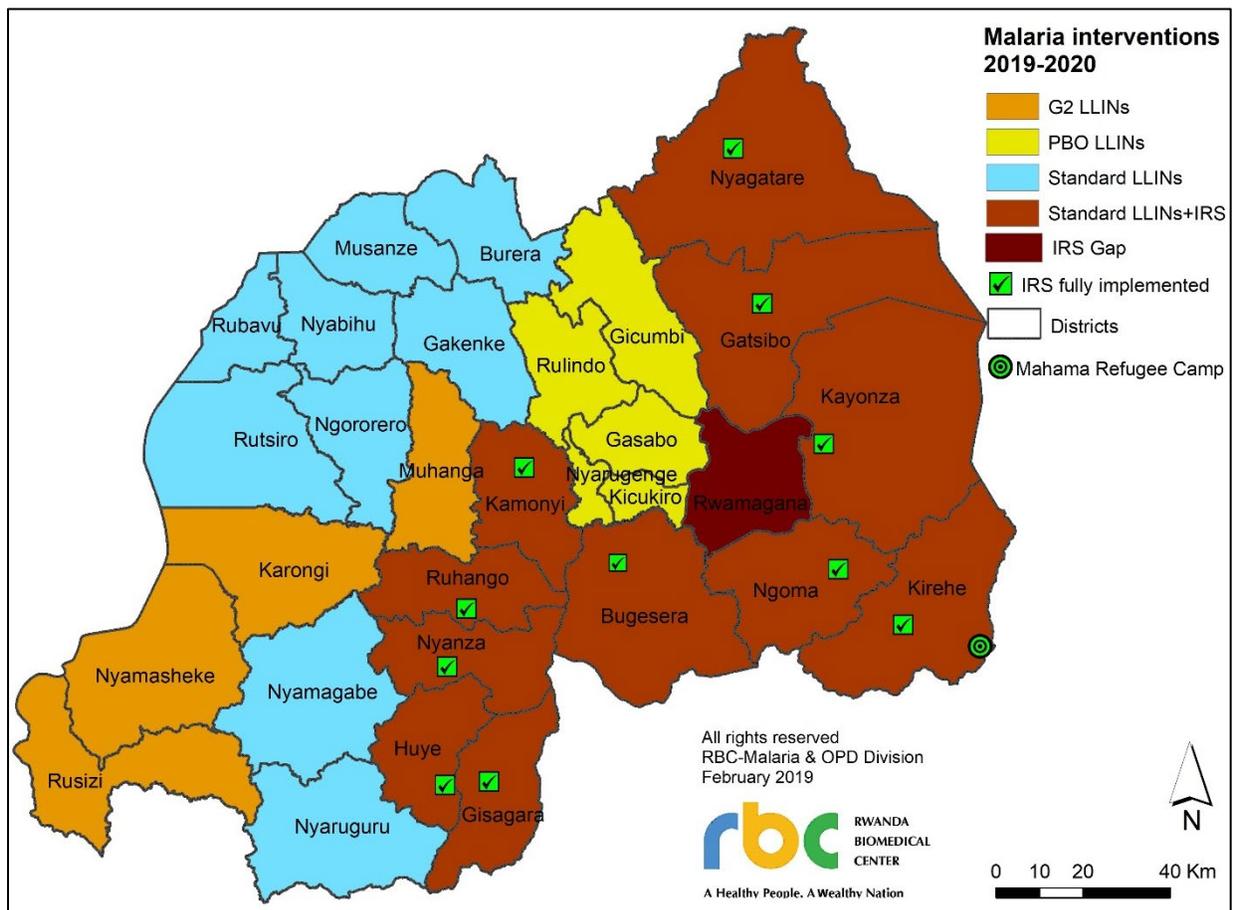


Table 2: Targeted Structures and Population for IRS in 2020

Kirehe*	12 of 12	91,319	185,380	175,852	361,232
Nyagatare	14 of 14	127,440	257,774	245,773	503,547
Ngoma	14 of 14	93,603	194,583	180,355	374,938
Total	40 of 40	312,362	637,737	601,980	1,239,717

*These numbers do not include Mahama refugee camp.

2.2 DISTRICT PLANNING MEETINGS

Following the MOH's decision to conduct blanket coverage of the three districts, VectorLink Rwanda deepened its collaboration and coordination with stakeholders. On July 17–19, 2020, the project held one-day micro-planning meetings in Nyagatare, Ngoma, and Kirehe districts respectively to discuss and develop an IRS operational plan and agree on the roles and responsibilities of each partner. The district leadership facilitated invitations to counterparts from local (sector) government, district hospitals, and health centers; and a total of 62 people (45 males and 17 females) participated in the three meetings. Issues discussed included:

- COVID-19 mitigation measures
- Criteria for spray operator and mobilizer selection/recruitment
- IEC
- Community leaders' involvement
- Identification of operations sites and storage space for IRS materials at the operations sites
- Role of districts/sectors in the provision of IRS operations site offices and stores
- Role of local leaders in supervision of IRS activities during the IRS operations
- IRS Walk to Work Strategy
- Mobile money payment system
- Spray operators' field simulation training
- Participation in weekly meetings at the sector level

The appropriateness of IRS operations sites was reviewed, discussed, and agreed upon. Each operations site with more than 25 spray operators had a second line of rinsing barrels. Those with more than 50 spray operators (three operations sites) had a second soak pit to facilitate washing activities and reduce water flushing in a single soak pit.

2.3 TRAINING

Before spray operations began, VectorLink Rwanda collaborated with the MOPDD to train personnel involved in IRS. Training on IRS implementation and supervision is central to the overall capacity-building strategy of PMI VectorLink. The project organized and conducted the spray operator and team leader trainings on August 17–21, 2020, in Kirehe, Ngoma, and Nyagatare districts. The trainees included a mix of new and previously trained spray operators, and team leaders with IRS experience. The major objective of the training was to equip the spray operators and team leaders with the skills to conduct a high-quality IRS campaign while observing preventive measures against the COVID-19 pandemic.

VectorLink Rwanda identified suitable training sites, reviewed the IRS training curricula and training materials, and conducted the TOT. The team leader training was increased from one day to three days to impart leadership and supervisory skills. The trainings were conducted in close collaboration with district and sector authorities, and were structured to reduce the risk of COVID-19 transmission, including handwashing upon arrival, distancing among participants, and the use of spacious, well-ventilated venues. Through district leadership, sector authorities provided all 40 training sites, which included school classrooms and multipurpose halls, free of charge in Nyagatare, Ngoma and Kirehe. The project trained 2,239 spray operators and 436 team leaders using 214 facilitators (who had attended the TOT) to conduct the training.

Table 3: Number and Type of People Trained to Support IRS, by Gender and Job Category

Category	Total	Males	Females	Total (% Female)
Team leaders	436	219	217	49.8%
Spray operators	2,239	1,108	1,131	50.5%
Adverse effect coordinators	3	3	0	0.0%
Sector Coordinators	48	31	17	35.4%
Sector Supervisors	108	56	52	48.1%
Sector IEC Assistants	48	24	24	50.0%
District IEC Assistants	3	2	1	33.3%
M&E Assistants	3	2	1	33.3%
Environmental Compliance Officer (ECO) Assistants	1	1	0	0.0%
Logisticians and storekeepers	58	25	33	56.9%
Adverse Effects Teams (clinicians)	67	52	15	22.4%
Drivers	82	82	0	0.0%
Spray Pump Technicians	6	6	0	0.0%
Sprayer cleaners	150	86	64	42.6%
Security guards	113	111	2	0.02%
Data Entry Clerks	56	25	31	55.3%
Finance Assistants	5	0	5	100.0%
Washers	159	54	105	66%
TOTAL	3585	1887	1698	47%

2.4 SPRAY OPERATION AND SUPERVISION

2.4.1 PEOPLE HIRED TO SUPPORT IRS CAMPAIGN

Table 5 lists the seasonal support staff recruited and deployed by VectorLink Rwanda for this year's spray campaigns. Selection criteria for spray operators and team leaders were: 1) a resident of the sector; 2) a CHW; 3) able to read and write; and 4) had medical clearance, based on a physical exam performed by a physician.

All spray operators, team leaders, washers, sprayer cleaners, and supervisors underwent medical tests prior to IRS training to ensure their fitness to participate in the operations. Sprayer cleaner is a new position specifically created to help with triple-rinsing, to reduce the time spray operators spend finalizing end-of-day clean-up and reduce congestion at the soak pits. The tests comprised a routine physical examination and a full blood count, as well as a pregnancy test for all women who could be exposed to insecticide during their work (storekeepers, Sector Supervisors, Sector Coordinators, team leaders and spray operators). Medical examiners found that 20 spray operators were unfit for IRS operations.

As Table 4 shows, the percentage of female spray operators is nearly 50%. This is because spray operators are recruited from the CHW pool at the village level; two of the three CHWs in each village are female. In addition, the project employed one female security guard and three female spray pump technicians; these roles have historically been held by men. However, the overall gender distribution of the workforce was greatly impacted by the very low percentage of female village IEC mobilizers. These local government roles and driving responsibilities tend to be perceived as men's roles because they require more hours and working at night.

Table 4: Seasonal IRS Staff Hired

Staff Position	Total		Total	% Females Hired
	Male	Female		
District IEC Assistants	2	1	3	33.3%
Seasonal District Coordinator	0	1	1	100.0%
Data Clerks	13	23	36	63.9%
M&E Assistants	2	1	3	33.3%
Data Cleaners	9	4	13	30.7%
District storekeepers	1	2	3	66.6%
Sector storekeepers	22	26	48	54.2%
Logistics Assistants	1	3	4	75.0%
Finance Assistants	0	4	4	100.0%
Environmental Compliance Assistant	1	0	1	0.0%
Sector Coordinators	30	19	49	38.7%
Sector Supervisors	43	53	96	55.2%
Sector IEC Assistants	30	18	48	37.5%
Spray operators	876	863	1,739	49.6%
Team leaders	224	212	436	48.6%
Security guards	110	1	111	0.01%
Washers	53	105	158	64.5%
Cell IEC Mobilizers	163	69	232	66.4%
Village IEC Mobilizers	3,011	418	3,429	12.2%
Pump Technicians	3	3	6	50.0%
Sprayer cleaners	86	64	150	42.6%

Staff Position	Total		Total	% Females Hired
	Male	Female		
Cleaners	2	4	6	66.6%
Total	4,682	1,894	6,576	28.5%

2.4.2 OPERATIONS SITES

For the 2020 IRS campaign VectorLink Rwanda used 48 operations sites and storage facilities, all of them donated by the Rwandan government.

The central VectorLink Rwanda warehouse at the Kicukiro Small-Scale Industrial Area in Kigali served as the hub for storage of IRS commodities, including insecticides before they were distributed to the target districts. VectorLink Rwanda reviewed the inventory records from the previous IRS campaign and assessed logistics needs in April–May 2020, including:

- Available stock of materials, consumables, and equipment
- Transport arrangements, including vehicle hiring for spray operations and supervision
- Estimate of insecticide, PPE, and spray equipment required
- Available disinfectant products and safety materials against the spread of COVID-19
- Mobilization and distribution of equipment, materials, and supplies

2.4.3 IRS SUPERVISION

VectorLink Rwanda implemented a supervision plan to ensure consistency and coordination of supervision and proper follow-up of corrective measures to improve spray operations performance. VectorLink Rwanda, the MOH/MOPDD, PMI, and local authorities at both the district and sector levels provided supervision for IRS activities at all levels.

In each district, a full-time VectorLink Rwanda staff member assisted the PMI VectorLink District Coordinator to coordinate routine daily supervision by working closely with the district staff and all other supervisors. At least six PMI VectorLink staff, in addition to the two full-time District Coordinators and one seasonal district coordinator, provided supportive supervision to the district and sector staff in the field from Monday to Friday weekly.

The officials from the MOPDD, who included the Head of MOPDD and Head of Vector Control Unit, participated in field IRS supervision. The MOPDD appointed three Adverse Effects Coordinators in three IRS targeted districts to work closely with the VectorLink Rwanda District Coordinators and other supervisors in the field during spray operations.

In addition, Rwanda Environment Management Authority (REMA) for the first time appointed one of its officers in charge of environmental protection and pollution control to work with VectorLink Rwanda in the field for the entire spray campaign period.

Local government officers (sector social affairs, heads of health centers, M&E Officers at district hospitals, and District Health Environmental Officers) dedicated two days each week to IRS supervision. The District Vice-Mayors and sector executive secretaries occasionally visited the teams in the field to supervise spray operations.

Table 5: Institutions/Stakeholders That Participated in IRS Supervision

Level	Institution and/or Individual	Responsibilities
National	MOH/MOPDD/Rwanda Bio-Medical Center; REMA; USAID/PMI; VectorLink Rwanda	Overall supervision of IRS activities
District and sector (local authorities)	District Vice-Mayor/Social Affairs; District Health Director; District Environmental Health Officer; Hospital Director; M&E Officer at district hospital; head of health centers; sector executive secretaries; sector social affairs	Close supervision in districts and environmental protection
Other	Home office-based M&E Specialist, Vector Control Manager, and Environmental Compliance Manager	Overall supervision of IRS operations, M&E, and environmental compliance activities

VectorLink Rwanda emphasized the need for strict supervision during the TOT and team leader trainings to ensure adherence to IRS best management practices (BMPs).

Additionally, VectorLink Rwanda supervisors in the districts met daily with the district teams to share and discuss challenges and observations from their supervision for immediate action and feedback to all spray teams. Staff from the MOPDD occasionally joined VectorLink Rwanda staff in the districts during daily virtual debriefing. During these interactions, MOPDD representatives and the VectorLink Rwanda team discussed the issues at hand and provided guidance to the District Coordinators and the teams in the field.

2.4.4 KEY OPERATIONS DETAILS

2.4.4.1 COVID-19 MITIGATION MEASURES

As VectorLink Rwanda took action to protect people from malaria, the project also ensured the health and safety of project staff, community members, and IRS spray teams against the risk of COVID-19 arising from project activities. The project was guided by PMI, the Government of Rwanda, and other global guidance to reduce the risk of transmission of COVID-19.

Some of the mitigation measures employed to protect spray teams included personal protection, including mandatory face coverings; the project procured reusable face masks and distributed two of them to every IRS actor at all 48 operations sites. Social distancing was also mandatory at all times, including in vehicles, during breakfast, at morning mobilization, inside households, and during end-of-day clean-up. Hands-free washing stations were installed at all training venues, operations sites, and project offices. Additionally, VectorLink Rwanda posted government COVID-19 posters in Kinyarwanda at all operations sites to remind spray teams to always follow COVID-19 preventive measures.

Daily temperature recordings were taken for all IRS cadres. Laptops and other touchable devices were disinfected and cleaned every day, as were toilets, bathrooms, changing rooms, doorknobs, and vehicles. VectorLink Rwanda increased the number of trainers per operations site to keep class sizes smaller to comply with safety protocols. School classrooms, multipurpose meeting halls, and churches were used as training venues for spray operators, to allow physical social distancing. Each classroom accommodated between 20 and 35 people during the training.

The Walk to Work Strategy was rolled out at all 48 operations sites and helped to reduce the number of people to be transported in IRS vehicles. Door-to-door mobilization was not conducted to reduce contact with households. Instead, community members were informed about the date of spray operators' arrival through megaphones and other mass media. The recruitment of a new IRS cadre (sprayer cleaners) to help with triple rinsing helped reduce delays spray operators would normally face during their end of day activities. Some staff were permanently posted to specific districts throughout the entire campaign period to avoid possible exposure because of movement to and from their homes.

2.4.5 INSECTICIDE PROCUREMENT AND USE

VectorLink Rwanda used Fludora[®] Fusion, a formulated combination of clothianidin (neonicotinoid) and deltamethrin (pyrethroid), during the 2020 IRS campaign. This was the second spray round in which this insecticide was used in the three districts. VectorLink Rwanda based its selection on data from insecticide susceptibility assays in 2020 and the MOH's recognition of Fludora[®] Fusion as a new insecticide for use in the country. The assays showed that the predominant local vector species (*Anopheles gambiae* s.l.) exhibited high levels of susceptibility to clothianidin. To manage insecticide resistance, specifically to pyrethroid insecticides, Rwanda decided in its National Strategic Plan for Insecticide Resistance Management in Malaria Vectors (2020-2024) to biannually rotate the type of insecticide to be sprayed.

VectorLink Rwanda procured both international and local commodities for the three districts, including 251,810 sachets of Fludora[®] Fusion and other IRS commodities. Local procurement involved an open competitive tendering process in which VectorLink Rwanda issued a solicitation for quotes for services and materials. The project procurement committee based its selection on the lowest-cost technically acceptable bid according to the criteria in the solicitation for the quotations.

VectorLink Rwanda used a total of 238,070 sachets for houses, and special structures which included prisons, transit centers and police quarters, during the August and September 2020 campaigns. On average, one sachet sprayed 1.4 structures (excluding special structures) (see Table 6). Each spray operator used on average 7.7 sachets per day, and sprayed on average 10.8 structures per day

Table 6: Insecticide Use

District	Total Structures Sprayed	Total Sachets Used	Average Number of Sprayed Structures per Sachet	Average Number of Sachets per Spray Operator per Day	Number of Structures Sprayed per Day per Spray Operator
Kirehe	94,827	68,734	1.38	7.9	10.9
Nyagatare	137,196	99,575	1.38	7.4	10.2
Ngoma	95,681	69,761	1.37	7.9	11.5
Total	327,704	238,070	1.37	7.7	10.8

2.5 IEC/SBC ACTIVITIES

2.4.6.1 Community Mobilization

The project conducted two days of community mobilization in targeted and sprayed villages in all three districts of Ngoma, Kirehe, and Nyagatare between August 24 and September 18, 2020. Because of the COVID-19 pandemic, the project shifted from a door-to-door approach to community mobilization this year. The IEC mobilizers communicated IRS messages to the owners of eligible structures and the dates of spraying using megaphones and other media. The sector coordinator and sector IEC Assistants, with support from the sector and cell social affairs officers, oversaw implementation of this activity. They also reviewed the IRS messages communicated to homeowners and ensured accuracy and uniformity.

VectorLink Rwanda conducted daily orientation of sector-level IEC mobilizers starting on August 20, 2020, in Ngoma, Kirehe and Nyagatare districts, using a new strategy of calling all village leaders in a cell that is to be sprayed for orientation trainings. The trainees were village and cell leaders whom VectorLink Rwanda recruited based on the following criteria: a cell or village leader and/or in charge of security at the village level should originate from that village, be a village committee member, be able to read and write, have a record of good conduct, be respectable, and be known by the community. Sector IEC Assistants, Sector Coordinators, and Sector Supervisors did the actual training while district IEC Assistants and VectorLink Rwanda staff

provided overall coordination. Key factors driving the low refusal rate include a very high level of collaboration and support from local leadership, and general community awareness of the importance and effectiveness of IRS in the fight against malaria.

Figure 3: House Marking of Eligible Structure



2.4.6.2 IEC Coordination

Local leaders at all levels readily provided support during the entire spray campaign period. Sector executives, sector social affairs, and sector community health workers were instrumental in linking spray operations teams to target communities. In each IRS district, a district IEC staff member coordinated and supervised district IEC activities. These people worked closely with the District Vice-Mayors in charge of social affairs and District Health Officers to supervise the district IEC activities. The Sector IEC Assistants and Sector Coordinators worked closely with sector and cell social affairs leaders to supervise IEC activities at the sector level.

As advised by the Government of Rwanda through its MOPDD, PMI VectorLink Rwanda returned to the previous approach of using two village leaders (the elected head of village and in-charge of security) to conduct community mobilization.

During the 2020 spray campaign, the spray operators carried IRS cards and issued them to the households on the day of spraying. The supervision team ensured that all village leaders had mobilized all eligible structures and informed homeowners about the date of spraying at least one day in advance. IEC teams worked according to the updated IRS schedule each day.

On the day of spraying, all village leaders worked with spray operators to give directions to the mobilized structures, facilitated the structure preparations by structure owners, and helped convince the structure owners who were hesitant about IRS to accept the spraying. All village leaders also noted structures that were not sprayed on the planned day and coordinated with spray operators to revisit them the following day.

2.4.6.3 Other IEC Activities

IRS Launch

VectorLink Rwanda organized an official launch of IRS operations in all three districts of Ngoma, Kirehe and Nyagatare in August 2020. Due to COVID-19, the launch events were smaller than in past years and carefully planned to align with Government of Rwanda and PMI guidance related to COVID-19 mitigation. Among the participants were Vice Mayors in charge of the social affairs sector, select cell and village leaders, the media, and a few community members. On average 15 people attended the IRS launch in each district. The launch events were broadcast on Rwanda national radio and covered on evening news headlines on two major television stations, Rwanda Television and TV10. The Vice Mayor in charge of social affairs in Nyagatare district had an opportunity to dress in PPE and participated in the spray demonstration inside a house (using water).

Community Mobilization by Local Leaders

Early advocacy and engagement by both VectorLink Rwanda and the MOPDD convinced local leaders to actively participate in mobilization activities. Sector executive secretaries, social affairs officers, and heads of health centers helped supervise IRS activities, and occasionally accompanied IRS teams to mobilize communities, especially where there were any refusals. The cell social affairs officers supervised the mobilization activities in their respective cells.

Additionally, during micro-planning meetings, VectorLink Rwanda together with local leaders strategized to start mobilization and spraying in urban centers so that all refusals would be documented and reported to local leaders early enough during spray operations for immediate action. For instance, government institutions that operate around townships made special arrangements to give time off to staff members to prepare their houses to be sprayed. Particularly in Nyagatare sector (a sector within Nyagatare district) an arrangement was made between VectorLink Rwanda, local leaders, and homeowners to spray urban structures on Saturday, when a majority of workers are available at home.

Nine live talk shows aimed at sensitizing the community to accept IRS and allow their homes to be sprayed were aired on radio stations (two on Radio Rwanda Nyagatare Branch and four on Radio Izuba) free of charge by the targeted districts' administrations from August 21 through September 18, 2020. Specific messages included the importance of IRS in the fight against malaria, the IRS campaign dates, the role of the community in IRS activities (before, during, and after spraying), management of adverse effects, and information about the funding agency.

Furthermore, 30 radio spots about IRS activities were aired on two major radio stations (10 spots on Radio Rwanda for Nyagatare district and 20 spots on Radio Izuba for Ngoma and Kirehe districts). The radio spots helped to reach a wide audience with IRS messages in just one minute.

Mass media communication also included banners at three IRS district offices and at all 48 operations sites. The message on the banners was “*Birakureba*” (Kinyarwanda for “This concerns you”). In addition, the Government of Rwanda provided one vehicle mounted with loudspeakers for two days in each district to raise community awareness about the IRS spray campaign.

2.6 CAPACITY BUILDING

In 2020, seven Government of Rwanda officials including three from the MOPDD participated in a virtual Regional Environmental Compliance workshop for four days. The objective was to increase the capacity of host country IRS staff across various facets of environmental compliance. In line with this, district and sector leaders and Data Managers will be trained in November 2020.

2.7 GENDER MAINSTREAMING

VectorLink Rwanda implemented all planned activities in the gender mainstreaming initiative in the operational plan. These are described below.

- **Training:** Incorporated gender sessions in all IRS training materials for discussion during the IRS training (TOT, mobilizer, and spray operator). The project also appointed gender focal points at the district and sector levels among the IRS support staff.
- **Increased recruitment of women:** Used micro-planning meetings with all district and sector authorities to discuss the importance of increasing the number of female spray operators by recruiting only CHWs with previous IRS experience. While the percentage of female spray operators was nearly 50%, the percentage of women participating in IRS implementation in 2020 overall was 28.8%, compared to 39.6% in 2019. This percentage reduction was mostly attributed to the increased number of village mobilizers recruited in all three districts, who were disproportionately male as they were recruited at the direction of the Government from elected village roles which are disproportionately held by men. The project had continued to advocate with the MOH to increase the number of female mobilizers. It had revised all vehicle tender adverts and encouraged vehicle vendors to hire at least 30% female drivers during IRS operations, but the 2020 spray campaign did not have any female drivers. The project employed three female pump technicians in the three targeted districts to work with the current male pump technicians at district warehouses, to further encourage women to apply for technical positions traditionally considered men's jobs. The project will continue to advocate for recruitment of more women for all IRS activities.
- **Safe work environment:** Ensured the work environment was suitable for mixed-gender teams by constructing separate standalone bathrooms for both men and women in each operations site.
- **Distribution of single-use pads to female workers:** Distributed 1,620 menstrual pads (450 in Kirehe; 704 in Nyagatare; 466 in Ngoma districts) to female seasonal workers during the spray campaign. The project did this to eliminate menstruation as a possible barrier to women's participation in the spray campaign.
- **Freedom from harassment guidelines and messages:** Posted the freedom from harassment guidelines in Kinyarwanda at each operations site to encourage professionalism and mutual respect. Prepared freedom from harassment messages and disseminated these regularly to all seasonal workers throughout the spray campaigns to enhance awareness and encourage women and men to elevate any harassment issues encountered during IRS operations.

Insecticide Serialization and Digital Scanning During the August–September 2020 spray round, VectorLink Rwanda scaled up a previous pilot of a mobile-based digital insecticide tracking system, where serialized insecticide sachets were tracked from operations sites storage to spray operators. Storekeepers labeled insecticide sachets with serial number stickers containing barcodes, after which the sachets were scanned and recorded before issuing them to team leaders.

The serialization and digital scanning were performed using a Cloud-based data recording and management system that allows VectorLink Rwanda managers at different levels to monitor and track the insecticide supply from operations site stores up to insecticide mixing at the household level. The Open Data Kit application installed on the tablets was used to scan the barcodes into a predesigned form, and the PMI VectorLink Home Office, VectorLink Rwanda staff, and other stakeholders could access these data using Google Sheets, which helped the Logistics Team to track the insecticide stock distribution at the IRS operations site online.

This approach was successful and the team is sharing lessons learned with other VectorLink country programs who are preparing to roll out digital scanning of serialized insecticide.

2.8 POST-SEASON REVIEW MEETINGS

These meetings were held in conjunction with the project IRS evaluation/review meetings at the district level. District and sector authorities, including army and police commanders, hospital and health center representatives, and MOH/MOPDD representatives, convened to do the following:

- Review the overall IRS implementation process, experiences, and achievements for the August – September 2020 spray campaign.

- Review IRS challenges in the three districts and identify recommendations for the next spray cycle.
- Reach consensus on the recommendations and way forward for future spray campaigns.

Discussions in the review meetings centered on supervision and individual sector IRS performance.

Recommendations included:

- Selection of spray operators *must* be done publicly at the health facility and strictly adhere to all MOH criteria. Any replacement of an unfit spray operator will draw from the waiting list established during the initial selection at the health centers.
- The district/sector authorities and health facility heads should enhance oversight of spray operator recruitment to ensure that spray operators are properly vetted.
- Local leaders (at sector and district level) should be trained on aspects of IRS to be able to play their key role during IRS supervision in their respective localities.
- The good collaboration and coordination between district leaders and VectorLink Rwanda that helped the project achieve excellent IRS results in 2020 should be maintained.
- Door-to-door mobilization should be reinstated to ensure maximum community sensitization on IRS activities.
- Sector authorities should participate actively in mobilization and implementation of spray operations in their sector to make the work of spray operators easier.
- Local leaders should definitively remove from the list of community health workers seasonal staff who misbehave during IRS spray campaigns.
- District and sector authorities, including health facilities, should continue providing facilities for storage of materials during the spray campaign, to save on expenses that the project would incur in renting storerooms, so that more structures can be sprayed.

Village leaders should always remind their community members not to paint, plaster, or resurface the walls of their houses for at least nine months after spraying, because covering the sprayed surface will negate the protective effect of the insecticide. In addition, recommendations for future years include:

- Reduce the daily target for spray operators to avoid the possibility of data falsification.
- Provide sufficient transportation for spray operators to reduce the distance that spray teams cover each day.
- Provide a list of unsprayed structures to local authorities for follow-up.

3. ENTOMOLOGICAL MONITORING

3.1 SPRAY QUALITY ASSESSMENT

To assess the different spray teams' quality of work, VectorLink Rwanda collaborated with the MOPDD to perform wall bioassay tests in the houses sprayed during the first week, using standard World Health Organization (WHO) wall cone bioassays conducted according to the project's Standard Operating Procedures (SOP009/01).

In each district, two sectors were selected. Nyagatare district (Nyagatare and Rukomo sector), Kirehe district (Gatore and Nyamugali sector) and Ngoma district (Remera and Zaza sector). In each sector, six structures with three different wall surfaces – PP, PNP, and mud, two of each – were sampled; these had been sprayed by different teams. The tests used both susceptible Kisumu strain (*Anopheles gambiae* s.s.) and wild reared *Anopheles* mosquitoes.

For the Kisumu strain, 100% of mosquitoes exposed to all structure and surface types were killed after 24 hours' holding time, except in Gatore on PNP and Nyamugali on PP. However, mortality was 100% after 48 hours for Gatore, and 72 hours for Nyamugali. For wild *Anopheles* mosquitoes, results showed that the mortality rate 24 hours post exposure ranged between 79% and 100%, but reached 100% in all sites on all type of walls at 72 hours post exposure (Table 7).

3.2 INSECTICIDE SUSCEPTIBILITY

Susceptibility of the main malaria vector, *Anopheles gambiae* s.l., to selected insecticides was assessed according to the project's Standard Operating Procedure (SOP006/01) for the WHO tube test. *Anopheles gambiae* s.l. from all project districts was susceptible to clothianidin, which is one active ingredient of the Fludora[®] Fusion that is being used in IRS in Rwanda. The vector was resistant to deltamethrin, permethrin, and lambda-cyhalothrin, but susceptibility to all three pyrethroids was fully restored with pre-exposure to PBO. The vector is still susceptible to pirimiphos-methyl and fenitrothion (organophosphate) and bendiocarb (carbamate), as shown in Table 8.

The fumigant effect varied between 76%–100%, 84%–100%, and 100% after 24, 48, and 72 hours' holding time respectively for Kisumu strain. For wild *Anopheles* mosquitoes it varied between 60%–100%, 90%–100%, and 100% after 24, 48, and 72 hours holding time respectively. The knockdown rate at 30 and 60 minutes post exposure was markedly lower for the wild mosquitoes than for the Kisumu colony in all the three types of surfaces and cone locations. The difference was less at the 24h and 48h post exposure holding period. Mortality was the same, at 100%, for both wild and Kisumu colonies at 72 hours. There was no marked variation in mortality by type of surface or the location of cones on walls.

Table 7: Results of Cone Bioassay for IRS Quality Assessment

Test Site	Types of Surfaces in Sprayed Rooms	#Mosquitoes Tested	<i>An. gambiae</i> s.s. (Kisumu Strain) % Knockdown/Mortality														
			Top				Middle				Bottom					Overall 24h	
			30'	60'	24h	48h	30'	60'	24h	48h	30'	60'	24h	48h	72h	Test	Control
Nyangatare	PP	60	95%	100%	100%		95%	95%	100%		90%	100%	100%			100%	0% (N=10)
	PNP	60	100%	100%	100%		90%	100%	100%		95%	100%	100%			100%	0% (N=10)
	Mud	60	90%	100%	100%		95%	100%	100%		90%	100%	100%			100%	0% (N=10)
Rukomo	PP	58	90%	100%	100%		95%	100%	100%		90%	100%	100%			100%	0% (N=10)
	PNP	59	90%	100%	100%		90%	100%	100%		95%	100%	100%			100%	0% (N=10)
	Mud	60	95%	95%	100%		90%	95%	100%		90%	95%	100%			100%	0% (N=10)
Gatore	PP	60	90%	100%	100%		85%	100%	100%		75%	100%	100%			100%	0% (N=10)
	PNP	62	75%	95%	100%		75.7%	96%	83.3%	100%	80%	95%	100%			94.4%	0% (N=10)
	Mud	60	95%	100%	100%		90%	100%	100%		95%	100%	100%			100%	0% (N=10)
Nyamugali	PP	58	100%	100%	79%	100%	96%	96%	90.9%	100%	94%	94%	88.5%	94%	100%	86%	0% (N=10)
	PNP	56	95%	100%	100%		88.3%	100%	100%		87.3%	100%	100%			100%	0% (N=10)
	Mud	60	100%	100%	100%		90%	100%	100%		100%	100%	100%			100%	0% (N=10)
Remera	PP	59	95%	100%	100%		100%	100%	100%		100%	100%	100%			100%	0% (N=10)
	PNP	60	100%	100%	100%		90%	100%	100%		100%	100%	100%			100%	0% (N=10)
	Mud	60	95%	100%	100%		90%	100%	100%		95%	100%	100%			100%	0% (N=10)
Zaza	PP	61	85%	90%	100%		86.6%	86.6%	100%		90%	100%	100%			100%	0% (N=10)
	PNP	57	95%	95%	100%		90%	100%	100%		90%	100%	100%			100%	0% (N=10)
	Mud	60	95%	95%	100%		95%	100%	100%		90%	100%	100%			100%	0% (N=10)

* **Bottom:** at 0.5 meter height from flow, **Middle:** 1.0 meter height from flow, **Top:** 1.5 meters height from flow.

Sectors highlighted in yellow are from Nyagatare district, in green sectors from Kirehe district, in blue sectors are located in Ngoma district.

Test Site	Types of Surfaces in Sprayed Rooms	#Mosquitoes tested	Wild <i>An. gambiae</i> s.l. % Knockdown/Mortality																
			Top					Middle					Bottom					Overall 24h	
			30'	60'	24h	48h	72h	30'	60'	24h	48h	72h	30'	60'	24h	48h	72	Test	Control
Nyangatare	PP	63	31%	54%	77%	81%	100%	20%	42%	96%	100%		21%	49%	63%	83.3%	100%	78.7%	0% (N=10)
	PNP	59	84%	94%	94%	100%		45%	90%	95%	100%		50%	100%	100%			96.3%	0% (N=10)
	Mud	59	65%	80%	80%	95%	100%	75%	75%	90%	100%		55%	75%	67%	83.3%	100%	79%	0% (N=10)
Rukomo	PP	60	80%	95%	95%	100%		55%	100%	100%			55%	90%	95%	100%		96.7%	0% (N=10)
	PNP	59	16%	78%	94%	100%		60%	100%	95%			40%	75%	95%	95%	100%	94.7%	0% (N=10)
	Mud	59	45%	95%	100%			45%	95%	100%			32%	90%	100%			100%	0% (N=10)
Gatore	PP	57	65%	85%	95%	100%		75%	75%	85%	100%		78%	85%	100%			93.3%	0% (N=10)
	PNP	57	57%	80%	100%			71%	77%	100%			75%	75%	100%			100%	0% (N=10)
	Mud	60	65%	90%	90%	100%		80%	95%	100%			50%	100%	100%			96.7%	0% (N=10)
Nyamugali	PP	52	60%	61%	80%	95%		47%	67%	87%	94%	100%	100%	85%	100%			89%	0% (N=10)
	PNP	54	60%	85%	95%	100%		65%	93%	100%			75%	100%	100%			98.3%	0% (N=10)
	Mud	64	80%	96%	100%			95%	100%	100%			88%	92%	100%			100%	0% (N=10)
Remera	PP	60	60%	70%	80%	85%		65%	80%	85%	100%		75%	75%	100%			88.3%	0% (N=10)
	PNP	60	60%	85%	100%			65%	75%	100%			55%	70%	100%			100%	0% (N=10)
	Mud	60	50%	65%	95%	100%		45%	75%	95%	100%		40%	45%	100%			96.7%	0% (N=10)
Zaza	PP	60	45%	90%	100%			30%	90%	100%			60%	95%	100%			100%	0% (N=10)
	PNP	59	50%	100%	100%			37%	95%	100%			30%	95%	100%			100%	0% (N=10)
	Mud	60	70%	95%	100%			70%	100%	100%			80%	100%	100%			100%	0% (N=10)

* **Bottom:** at 0.5 meter height from flow, **Middle:** 1.0 meter height from flow, **Top:** 1.5 meters height from flow.

Sectors highlighted in yellow are from Nyagatare district, in green sectors from Kirehe district, in blue sectors are located in Ngoma district.

Table 8. Insecticide Resistance Monitoring Results in Project Districts: June 2019 through July 2020

Sites	% Mortality										
	Deltamethrin 0.05%		Permethrin 0.75%		Lambda-cyhalothrin 0.05%		Pirimiphos-methyl 0.25%	Bendiocarb 0.1%	Fenitrothion 1%	DDT 4%	Clothianidin
	w/o PBO	PBO	w/o PBO	PBO	w/o PBO	PBO					
Nyagatare	76	100	54	100	53	100	100	99	100	97	100
Ngoma	66	100	43	100	40	100	100	98	100	62	100
Kirehe	82	100	74	100	88	100	99	100	100	94	100
Nyaruguru	98		88		95		100	99	100	98	

Note: 98–100%: Susceptible (green); 90–<98%: Suspected resistance (yellow); <90%: Confirmed resistance (red).

4. ENVIRONMENTAL COMPLIANCE

VectorLink Rwanda operates under a Supplemental Environmental Assessment (SEA), which is valid nationwide through 2021. This SEA and amendment authorizes the nationwide use of approved insecticides in the pyrethroid, carbamate, organophosphate, and neonicotinoid classes, and chlorfenapyr (pyrrole class) when recommended by the WHO Prequalification Team. VectorLink Rwanda prepared a Pre-Spray Letter Report in June 2020 that highlighted the environmental compliance plan and choice of insecticides for the campaign.

The status of the project’s environmental mitigation and monitoring measures is documented in Annex B.

4.1 IRS CAMPAIGN ASSESSMENTS

In 2020, the VectorLink Rwanda ECO, in collaboration with representatives from REMA and the MOH, conducted environmental compliance assessments and inspections before, during, and after IRS operations. These assessments helped to ensure that all environmental safeguards for storage and waste disposal facilities were in place, and that procedures, as mandated by the Environmental Mitigation and Monitoring Plan, were adhered to at each IRS operations site, and during all operations.

Initial Pre-Season Environmental Compliance Assessments (PSECAs) were conducted on August 17–21, 2020 at all 48 operational sites in the districts of Kirehe, Nyagatare, and Ngoma using checklists embedded on smartphones. Data collected from the smartphone were uploaded to the Abt Associates environmental compliance database and generated a “Greenlight” if the site was ready or a work list for remedial action to be taken if there was a deficiency. The work lists generated by the Open Data Kit application during the initial PSECA were complemented by the inspection team’s trip report, which contained more-detailed recommendations for addressing the deficiencies. VectorLink Rwanda resolved all gaps identified during the initial PSECA and brought all facilities into compliance. This included the renovation of 34 soak pits and construction of 14 new soak pits. The final PSECA, completed two weeks before the scheduled start of the campaign, verified the completion of all rehabilitation activities and confirmed the readiness of each operations site. An authorization meeting was held with the Home Office Environmental Compliance Manager to authorize insecticide deployment to operations sites that have met all the requirements.

Table 9: Preparation of IRS Operation Sites

District	Number of Operations Sites	Site Refurbished (Soak Pit, Storeroom, Fence, Etc.)
Nyagatare	18	20 soak pits All soak pits were refurbished. All concrete wash areas of soak pits were extended to the size of 4x6 meters. All 18 offices and storage facilities were provided by sector and cell authorities
Kirehe	16	All soak pits were refurbished All 16 concrete wash areas of 15 soak pits were extended to the size of 4x6 meters. All 16 offices and storage facilities were provided by sector and cell authorities
Ngoma	14	All 14 concretes wash areas of 14 soak pits were constructed and extended to the size of 4x6 meters.
All Districts	48	All storage facilities were provided by local authorities free of charge.

To reinforce compliance with environmental guidelines, monitoring and supervision were conducted, using five checklists embedded on smartphones. All noncompliance issues were resolved in collaboration with the Operations Manager and the coordinators in a timely manner. Challenges experienced and lessons learnt are detailed in the Environmental Mitigation and Monitoring Report in the Annex, which tabulates the number of supervision inspections recorded during the 2020 IRS campaign.

In September 2020, VectorLink Rwanda staff conducted the Post-Season Environmental Assessments in all 48 sites using the smartphone-embedded checklists. These assessments confirmed that all IRS items, including insecticides and IRS waste, were collected from the operations sites and returned to the central warehouse; all soak pits and their surroundings areas had been cleaned, cleared of any waste, and secured with locks; and all wash areas had been covered with plastic sheets to prevent vandalism or contamination by humans and animals.

4.2 INCIDENT REPORTS

A team was in charge of adverse effects in each district. The team comprised a coordinator, a doctor who was based at the district hospital, and a nurse at each health center affiliated with each IRS operations site. These teams worked closely with the ECO; their role was to address adverse effects that community members and/or the spray operations support staff might experience during spray operations.

The project reported four incidents to PMI during the 2020 spray campaign, in accordance with incident report requirements and summarized in Table 10.

Table 10: Summary of Incidents Reported during IRS

	Description	Location
1	Motorcyclist attempted to overtake the IRS vehicle and ran off the road into a trench and died of injuries.	Ngoma
2	Vehicle accident: a six-year-old child died of injuries after trying to climb an IRS vehicle.	Nyagatare
3	The local authorities alongside with police discovered 10 sachets of insecticide (Fludora® Fusion) which had been stolen by a Team Leader.	Nyagatare
4	Insecticide theft and data falsification in Karangazi.	Nyagatare

4.3 DEMOBILIZATION AND WASTE MANAGEMENT

Following completion of IRS operations, the site storekeepers updated their stock records and balanced inventory records before closing the storerooms. Subsequently, VectorLink Rwanda segregated, collected, and transported all commodities from the operations site stores to the central warehouses in Kigali.

Solid wastes generated from the 2020 IRS Campaign in Rwanda were sorted and stored in clearly labelled sacks or barrels at each operations site before transportation to the central storage warehouse in Kigali prior to disposal. They were classified and separated into contaminated wastes and uncontaminated wastes. All contaminated wastes were collected at the operations site stores, then transported to the main warehouse for temporary storage prior to incineration.

VectorLink Rwanda signed a billing contract with district hospitals for thermal destruction of insecticide sachets, used paper nose masks, wet wipes, and contaminated cardboard boxes, in hospital incinerators. In 2018 VectorLink Rwanda signed a Memorandum of Understanding with two companies for a five-year period to ensure environmentally friendly disposal of plastic and paper waste: Rotassairwa plastic recycling plant and the Card from Africa paper recycling plant. Through an agreement with the Rwandan government and the Enviroserve Rwanda Green Park, the VectorLink Rwanda project recycled e-waste such as lithium batteries and damaged torches at the Enviroserve Rwanda E-Waste Dismantling and Recycling Facility. Please see additional detail in Annex B.

5. MONITORING AND EVALUATION

5.1 DATA COLLECTION, ENTRY, AND QUALITY ASSURANCE

VectorLink Rwanda incorporated all PMI VectorLink M&E protocol updates, including enhancements to the data collection tools, before the start of mobilization and spraying, to ensure collection, management, and reporting of high-quality data.

5.1.1 DATA COLLECTION

Spray operators collected spray data on paper forms, which team leaders and supervisors verified and transmitted to the data centers for entry. Because of COVID-19 preventive measures, M&E Assistants and Data Entry Clerks waited 24 hours before touching the forms and performing a final verification of spray data and calculations and entering the data into PMI VectorLink Collect. At the end of each day, the Database and M&E Manager reviewed the data for anomalies and addressed issues with data center staff. Data Entry Clerks entered all data within 48 hours of spraying for quality control purposes and timely generation of weekly spray progress reports. They also filed and archived Daily Spray Operator Forms at each data center.

5.1.2 QUALITY ASSURANCE

Because of the COVID-19 pandemic VectorLink Rwanda didn't perform daily data collection verification visits to check the accuracy of data collected by spray operators. This was a project-wide decision that affected all PMI VectorLink countries. VectorLink Rwanda used other supervision strategies, such as assigning every team leader to follow one spray operator in her/his team for the first week. There were some issues with data quality, which are documented in Section 6, Challenges and Lessons Learned.

Data were cleaned through PMI VectorLink Collect on a daily basis to ensure that any data entry mistakes were immediately corrected. Also, built-in database validations prevented Data Entry Clerks from making too many errors. Data Entry Clerks performed double data entry in the targeted districts, whereby they initially entered spray totals or a summary of each Daily Spray Operator Form to produce real-time reporting of spray progress. Thereafter, they entered spray details data (i.e., line-by-line or structure-by-structure), which generated this end-of-spray report and all other PMI reports. During a thorough cleaning process the project investigated and reconciled discrepancies between spray totals, and detailed data before finalizing and reporting campaign results.

6. CHALLENGES AND LESSONS LEARNED

6.1 CHALLENGES

- Because of the COVID-19 pandemic the project was not able to conduct daily data collection verification and door-to-door mobilization during the IRS campaign. The project also engaged first-time IRS supervisors because three districts were being sprayed simultaneously. Perhaps as a result, the project encountered data falsification and insecticide theft by some spray operators and team leaders in two sectors in Nyagatare district. Once these issues were discovered, the project team with support from district leadership took proactive actions to investigate the incidents and address the problem. This issue was discovered late in the campaign; data collection verification was conducted in all three districts after the campaign ended to better understand the scope of the problem. Additionally, in the two sectors that reported data falsification, Karangazi and Rwimiyaga, a structure verification exercise was conducted to determine how many structures captured on the data collection forms do not exist. Finally, it was noted from these exercises that spray operators, particularly in Nyagatare district, struggled to record non-sprayed structures in some sectors.
- Because of COVID-19 the project reduced the number of spray operators to be transported in one vehicle from 26 to 12 passengers, which increased the distance that spray operators had to walk to find structures and caused spray operators to return to the operational sites late and tired. The new sprayer cleaners employed this year assisted with cleaning of sprayers, allowing spray operators to move quickly through end of day clean up and return home sooner.
- Preparation and implementation of IRS in three districts in the COVID-19 pandemic situation was a challenge for both the project team and the partners. Spraying three districts simultaneously compelled project staff and other supervisors to oversee spray operations across regions and in non-contiguous districts. This resulted in delegated authority and at times larger supervisory gaps.
- Some sector supervisors were not correctly filling out digital supervision checklists, and in all three districts some operations sites were not adhering to standard insecticide use rates. This may have been because new supervisors were less familiar with the project's digital checklists.
- Restrictions on movement of people were tightened, and a curfew was set at 7 p.m. in an effort to further reduce increases in COVID-19 cases in the country. These restrictions reduced VectorLink Rwanda's ability to bring daily spray reports to the district data centers after 6 p.m. However, sector coordinators submitted their daily IRS performance reports via email, WhatsApp groups or SMS platforms. In addition, VectorLink Rwanda adapted its data transportation plans to collect hard copies of spray operator forms from the prior day in the mornings.
- Digital scanning of serialized insecticide sachets was implemented across all 48 operations sites for the first time, following a successful pilot of digital scanning in Ngoma in February 2020. Challenges were encountered, such as incompatibility of devices with barcode scanning, submission errors, and troubleshooting issues. With support from the home office team, the team was able to address these challenges and use digital scanning at all sites.

6.2 LESSONS LEARNED AND RECOMMENDATIONS

- The project should implement daily data collection verification to catch falsified data early on. The project should also review its IRS card distribution strategy in order to have village mobilizers distribute the cards

and put structure IDs on IRS cards to avoid possible data falsification. In addition, a post spray data quality audit (PSDQA) will be conducted in 2021.

- Maintain the role of sprayer cleaners to allow ample time for spray operators to reconcile insecticide with storekeepers, reduce congestion in wash areas, and facilitate faster and more-efficient end-of-day clean-up.
- Consider capacity building of local leaders in the project's existing spray districts to scale their contribution to IRS implementation.
- VectorLink Rwanda recommends conducting door-to-door mobilization in the targeted districts to strengthen IRS awareness and avoid issues related to data falsification when community mobilizers issue IRS cards.
- The daily virtual debriefing has been very useful for IRS coordination and communication during the COVID-19 pandemic, and was much appreciated by Government of Rwanda partners. This should be sustained for quick decision-making.
- Other social media such as WhatsApp groups helped to share timely daily reports and information.
- To improve team leader Directly Observed Spraying reporting, enhance supervision of team leaders and encourage them to vigilantly report issues/red flags noted during supervision, even if the issue has been corrected.
- Continue to engage local leaders at district and sector levels to enhance mobilization and coordination of IRS activities in both urban and rural areas, as it proved to increase acceptance of IRS.
- Strict adherence to COVID-19 mitigation measures resulted in an IRS campaign without any known COVID-19 cases or exposures. IRS can safely continue during COVID-19 in settings where community spread of COVID-19 is well managed, with widespread testing, contact tracing, and isolation available from the health authorities.
- Adhere to spray operator recruitment procedures by engaging the officer in charge of CHWs at the health center, followed by verification and approval by the heads of health centers, sector social affairs, and the sector executive secretary.
- Enhanced supervision by PMI VectorLink staff and by district, sector, MOPDD and other Government of Rwanda institutions, as well as regular feedback, expedited the smooth IRS implementation and achievement of high spray coverage.
- Advocate for recruiting only those CHWs who have IRS experience. Micro-planning meetings with district and sector authorities will discuss the importance of adhering to the recruitment criteria set by the MOH, and increase the number of women spray operators in IRS activities.

ANNEX A: MONITORING AND EVALUATION PLAN

#	Performance Indicator	Dis-aggregation	Annual Targets and Results									
			Year 1		Year 2		Year 3		Year 4		Year 5	
			Target	Result	Target	Result*	Target**	Result	Target	Result	Target	Result
Objective 1: Implementation of Malaria Vector Control (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											
1.1.2	Number of eligible structures targeted for spraying	Total (All)	213111	215467	304798	319772	315500	319772				
		Targeted Districts	206611	208687	298018	312362	308090	312362				
		Mahama Refugee	6500	6780	6780	7410	7410	7410				
1.1.3	Number of eligible structures sprayed with IRS[1]	Total (All)	181144	214802	259078	314517	268175	334802				
		Targeted Districts	175619	208026	253315	307130	261877	327704				
		Mahama Refugee	5525	6776	5763	7387	6298	7098				
1.1.4	Percentage of total structures targeted for spraying that were sprayed with a residual insecticide (Spray Coverage)	Total %	85%		85%		85%					
		Targeted Districts	85%	99.70%	85%	98.3%	85%	99.7%				
		Mahama Refugee	85%	99.90%	85%	99.7%	85%	100.0%				
1.1.5	Number of people protected by IRS	Total (All)		894098	1269184	1288952	1299158	1355656				
		Subtotal: Targeted Districts	813177	840773	1215859	1229657	1239717	1295240				
		Sex: Male		405691		591941		622851				
		Sex: Female		435082		637729		672839				
		Pregnant women		12132		16871		17863				
		Children <5		117881		167492		175,504				

#	Performance Indicator	Dis-aggregation	Annual Targets and Results									
			Year 1		Year 2		Year 3		Year 4		Year 5	
			Target	Result	Target	Result*	Target**	Result	Target	Result	Target	Result
		Subtotal: Mahama Refugee	53000	53325	53325	59295	59441	60416				
		Sex: Male		27148		29874		30413				
		Sex: Female		26177		29421		30003				
		Pregnant women		1328		1622		1605				
		Children <5		9810		11600		12307				
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)	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	Country										
1.1.8	Number of Insecticide Treated Nets (ITNs) distributed, by channel	Channel	N/A	N/A	N/A	N/A	N/A	N/A				
1.1.9	Number and percentage of countries completing ITN durability monitoring data collection as planned in a given project year	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	Country										
1.2	Strengthen Capacity of NMCPs, VC Personnel, and Other Institutions to Implement and Manage IRS and Other VC Activities											
1.2.1	Total number of people trained to support VC in target areas	Total	5253	4762	4762	4376	4328	3585				
		VC Intervention	IRS	IRS	IRS	IRS	IRS	IRS				
		Sex: Male		3384		2620		1887				
		Sex: Female		1378		1756		1698				
		Job Function		See Table 2		See Table 2		See Table 2				

#	Performance Indicator	Dis-aggregation	Annual Targets and Results									
			Year 1		Year 2		Year 3		Year 4		Year 5	
			Target	Result	Target	Result*	Target**	Result	Target	Result	Target	Result
1.2.2	Total number of people trained to support VC in target areas with USG funds[2]	Total	1500	1710	1710	2874	2848	2882				
		VC Intervention	IRS	IRS	IRS	IRS	IRS	IRS				
		Sex: Male		758		1413		1440				
		Sex: Female		952		1461		1442				
		Job Function		See Table 2		See Table 2		See Table 2				
1.2.3	Number of people trained during the Master (National) Training and/or IRS Training of Trainers.	Total	340	131	208	124	124	214				
		Sex: Male		76		71		119				
		Sex: Female		55		53		95				
		Type of Training		TOT		TOT		TOT				
1.2.4	Total number of people hired to support VC in target areas.	Total	4572	4540	6380	3675	3677	6576				
		VC Intervention	IRS	IRS	IRS	IRS	IRS	IRS				
		Sex: Male		3228		2218		4682				
		Sex: Female		1312		1457		1894				
		Job Function		See Table 2		See Table 2		See Table 2				
1.2.5	Number of VC project training workshops targeting NMCP and other host country staff	Total	1	2	1	3	2	0				
		Technical Area		Ento technicians		IRS Implementation and Capacity Building; M&E						
		Job Function		See Table 2		See Table 2		See Table 2				
1.2.6	Number of NMCP and other vector control host country staff who have logged into VectorLink Collect	Total	N/A	N/A	8	10	8	10				
		Job Function				See Table 2		See Table 2				
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	Country										
		Technical Area										
		Channel										
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	Country										
		Channel										

#	Performance Indicator	Dis-aggregation	Annual Targets and Results									
			Year 1		Year 2		Year 3		Year 4		Year 5	
			Target	Result	Target	Result*	Target**	Result	Target	Result	Target	Result
1.3	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	Total	5225	4737	4301	4367	4328	3524				
		Sex: Male (#, %)		3368 (71%)		2583 (59.1%)		1862 (52.8%)				
		Sex: Female (#, %)		1369 (29%)		1784 (40.8%)		1662 (47.2%)				
		Job Function		See Table 2		See Table 2		See Table 2				
1.3.2	Number of health workers receiving insecticide poisoning case management training	Total	42	47	63	61	61	67				
		Sex: Male (#, %)		35 (74%)		43 (70.5%)		52 (77.6%)				
		Sex: Female (#, %)		12 (26%)		18 (29.5%)		15 (22.4%)				
1.3.3	Number of adverse reactions to pesticide exposure documented that resulted in a referral for medical care	Total	0	1	0	0	0	0				
		Type of Exposure										
1.3.4	Number of SEAs and Letter Reports submitted at least 60 days prior to the commencement of VC campaigns	Country										
1.3.5	Number and percentage of permanent and mobile soak pits inspected and approved prior to IRS campaigns or before first use	Total Number	35	36	50	50	52	50				
		Percent	100%	100%	100%	100%	100%	100%				
1.3.6	Number and percentage of storehouses inspected and approved prior to IRS campaigns	Total Number	37	37	52	52	52	52				
		Percent	100%	100%	100%	100%	100%	100%				
		Type: Sector Store		34		48						
		Type: Central Warehouse		1		1						
	Type: District Warehouse		2		3							
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	Number		1312		1457		1893				
		Percent	35%	29%	35%	39.6%	45%	28.7%				
		Job Function		See Table 2		See Table 2		See Table 2				

#	Performance Indicator	Dis-aggregation	Annual Targets and Results									
			Year 1		Year 2		Year 3		Year 4		Year 5	
			Target	Result	Target	Result*	Target**	Result	Target	Result	Target	Result
1.4.2	Number and percentage of women hired in supervisory roles in target areas for VC activities	Number		240		303		334				
		Percent	50%	42%	50%	48%	50%	48.6%				
		VC Intervention	IRS	IRS	IRS	IRS	IRS	IRS				
		Job Function										
1.4.3	Number and percentage of trainees (permanent and seasonal) who have completed gender awareness training	Total	5115	4444	4444	2874	2305	2889				
		Sex: Male (#, %)		3166 (71%)		1413 (49.2%)		1446 (50%)				
		Sex: Female (#, %)		1278 (29%)		1461 (50.8%)		1443 (50%)				
		Job Function		See Table 2		See Table 2		See Table 2				
1.4.4	Number and percentage of women in senior leadership roles in VectorLink country offices	Country										
		Sex (# and %)										
1.5	Implement and Support SBCC and Mobilization Activities											
1.5.1	Number of radio spots and talk shows aired	Total	0	12	1	4	6	39				
		VC Intervention		IRS		IRS		IRS				
								9 Radio talk shows				
		Talk Show or Radio Spot				Radio talk show		30 Radio spots				
1.5.2	Number of print materials distributed to or targeted at beneficiaries	Total	0	0	0	0	0	0				
		VC Intervention										
1.5.3	Number of people reached with vector control and/or SBCC messages via door-to-door messaging	Total	447447	459678	358969	186,725	0	0				
		VC Intervention		IRS		IRS						
		Sex: Male		209421		83,825						
		Sex: Female		250257		102,900						

#	Performance Indicator	Dis-aggregation	Annual Targets and Results									
			Year 1		Year 2		Year 3		Year 4		Year 5	
			Target	Result	Target	Result*	Target**	Result	Target	Result	Target	Result
2. 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)	Total	19	19	7	9	7	7				
		VC Intervention		IRS		IRS		100%				
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)	Total Number	19	19	7	9	7	7				
		Percent	100%	100%	100%	100%	100%					
		VC Intervention		IRS		IRS		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	Total Number	19	19	7	9	7	7				
		Percent	100%	100%	100%	100%	100%	100%				
		IRS or Entomology Only Program		IRS		IRS						
2.1.4	Number and percentage of insecticide resistance monitoring sites that tested all priority insecticides for the relevant local vector control intervention [3]	Total Number	12	12	4	4	4	0				
		Percent	100%	100%	100%	100%	100%					
		VC Intervention		IRS		IRS						
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	Total Number	N/A	N/A	36	36	36	36				
		Percent			100%	100%	100.00%					
		Insecticide Type				Fludora® Fusion		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	Total Number	N/A	N/A	6	6	6	0				
		Percent			100%	100%	100%					
		Insecticide Type				Fludora® Fusion						

#	Performance Indicator	Dis-aggregation	Annual Targets and Results												
			Year 1		Year 2		Year 3		Year 4		Year 5				
			Target	Result	Target	Result*	Target**	Result	Target	Result	Target	Result			
2.1.7	Number of countries with an integrated vector control analytics dashboard created by PATH, available for decision-making	Country													
2.1.8	Number of people trained (VectorLink and non VectorLink staff) in entomological monitoring	Total	20	66	24	60	66	0							
		Sex: Male (#, %)		Male (42, 63.6%)		Male (36, 60%)									
		Sex: Female (#, %)		Female (24, 36.4%)		Female (24, 40%)									
2.1.9	Number and percentage of sites in which WHO cone bioassays were conducted to evaluate bio-efficacy of bed nets	Total Number			0	0	4	0							
		Percent													
2.1.10	Number of nets in which WHO cone bioassays were conducted to evaluate bio-efficacy of bed nets	Total			0	0	60	0							
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	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	Country													
2.2.3	Number of countries that implement sub-national insecticide rotation	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	Total	N/A	N/A	4	6	0	2							
		Job Function				MOPDD		Data Managers							
		Organization				MOPDD		MOPDD							

#	Performance Indicator	Dis-aggregation	Annual Targets and Results									
			Year 1		Year 2		Year 3		Year 4		Year 5	
			Target	Result	Target	Result*	Target**	Result	Target	Result	Target	Result
2.3.2	Number and percent of targeted individuals that report using new analytical tools and/or skills in their planning, resourcing, implementation, or measurement activities	Total	N/A	N/A	4	6	0	2				
		Job Function				MOPDD		Data Managers				
		Organization				MOPDD		MOPDD				
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	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	Total Number	1	1	1	1	1	1				
		Percent	100%	100%	100%	100%	100%	100%				
		Insecticide Type		Actellic 300CS		Fludora® Fusion		Fludora® Fusion				
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	Country										
		VC Intervention										
3.1.4	Number of VectorLink staff trained on procurement	Country										
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	Total Number	47	40	39	39	39	58				
		VC Intervention		IRS		IRS		IRS				
		Male		11 (30%)		16 (41%)		25 (43.1%)				
		Female		29 (70%)		23 (59%)		33 (56.9%)				
		Job Function		See Table 2		See Table 2		See Table 2				
3.2.2	Number and percentage of operations site warehouses where physical inventories can be verified by daily stock records	Total Number	37	37	48	48	36	48				
		Percent	100%	100%	100%	100%	100%	100%				

#	Performance Indicator	Dis-aggregation	Annual Targets and Results										
			Year 1		Year 2		Year 3		Year 4		Year 5		
			Target	Result	Target	Result*	Target**	Result	Target	Result	Target	Result	
3.2.3	Number and percentage of IRS countries that successfully completed spray operations without an insecticide stock-out	Country											
		Insecticide Type											
4. Innovation													
4.1	Conduct operational research or monitoring to scale up new tools, methods, and approaches												
4.1.1	Number of operational research studies on promising new tools or new methods/approaches to existing tools that are implemented	Total Number	0	0	0	0	0	0					
		Type of Innovation											
4.2	Create and share knowledge through dissemination of best practices and lessons learned												
4.2.1	Number of innovations, best practices, and other data or lessons learned shared with other partners or international institutions for global reporting on the Vector Learning Exchange	Country											
		Technical Area											
4.2.2	Number of individual members who use the Vector Learning Exchange	N/A											
4.2.3	Number of symposia and/or presentations submitted to and accepted at global conferences	Total	1	1	1	0	0	0					
		Technical Area		Entomology									
4.2.4	Number of success stories written or videos produced and shared on the VectorLink project website	Total	0	1	0	3	0	0					
4.2.5	Number of peer-reviewed journal articles submitted and accepted	Technical Area											
4.2.6	Number of contributions to vector control global or country policy and/or guidance documents	Total	0	0	0	0	0	0					
		Technical Area											
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	Total	1	1	0	1	0	0					
		VC Intervention		IRS: Walk to Work Strategy		IRS: New mobilization strategy							

#	Performance Indicator	Dis-aggregation	Annual Targets and Results									
			Year 1		Year 2		Year 3		Year 4		Year 5	
			Target	Result	Target	Result*	Target**	Result	Target	Result	Target	Result
4.3.2	Number of cost effectiveness assessments of existing approaches in the implementation of IRS and integrated malaria vector control programs	Total	0	1	0	1	1	1				
		VC Intervention		IRS: Walk to Work Strategy		IRS: New mobilization strategy		0				
4.4	Cultivate public-private partnerships											
4.4.1	Number of private sector entities engaged with to establish public private partnerships to increase the quality and coverage of malaria vector control activities globally	Total	1	3	3	3	3	3				
[1] Target based on 85% of estimated eligible structures in indicator 1.1.2 [2] For IRS programs, this includes spray operators, team leaders, and supervisors. [3] Performed by MOPDD with funding from GF												

#	Selected Indicators with Job Function Disaggregates	By Job Function	Annual Targets and Results										
			Year 1		Year 2		Year 3		Year 4		Year 5		
			Target	Result	Target	Result	Target	Result	Target	Result	Target	Result	
1.2	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	Total	5253	4762	4762	4376	4328	3585					
		District IEC		2		2		3					
		Sector Coordinators		34		34		48					
		Sector IECs		68		34		48					
		Supervisors		61		54		108					
		M&E Assts		0		0		3					
		ECO Assts		0		0		1					
		Adverse Effects Coordinators		0		0		3					
		Spray Operators			1278		2312		2239				
		Team Leaders			301		438		436				
		Clinicians			49		61		67				

#	Selected Indicators with Job Function Disaggregates	By Job Function	Annual Targets and Results									
			Year 1		Year 2		Year 3		Year 4		Year 5	
			Target	Result	Target	Result	Target	Result	Target	Result	Target	Result
		Data Clerks		22		44		56				
		Storekeepers, Logistics		40		38		58				
		Security Guards		72		100		113				
		Washers		113		158		159				
		Pump Cleaners		0		0		150				
		Spray Pump Technicians		4		6		6				
		Finance Assistants		3		3		5				
		Drivers		55		93		82				
		Cell IEC Mobilizers		166		65		0				
		Village IEC Mobilizers		2494		934		0				
		Total	1500	1710	1710	2874	2848	2882				
1.2.2	Total number of people trained to support VC in target areas with USG funds[2]	District IEC		2		2		3				
		Sector Coordinators		34		34		48				
		Sector IECs		34		34		48				
		Supervisors		61		54		108				
		SOPs		1278		2312		2239				
		Team Leaders		301		438		436				
		Total	4572	4540	6380	3675	3677	6576				
1.2.4	Total number of people hired to support VC in target areas.	Seasonal District Coordinator		0		0		1				
		District IEC Asst		2		3		3				
		Data Clerks		19		36		36				
		M&E Assistants		2		3		3				
		Data Cleaners		2		13		13				
		District Storekeepers		3		3		3				

#	Selected Indicators with Job Function Disaggregates	By Job Function	Annual Targets and Results											
			Year 1		Year 2		Year 3		Year 4		Year 5			
			Target	Result	Target	Result	Target	Result	Target	Result	Target	Result		
		Sector Storekeepers		34		48		48						
		Logistics Assistants		3		5		4						
		Finance Assistants		3		4		4						
		Environmental Compliance Asst		0		0		1						
		Sector Coordinators		34		48		49						
		Sector Supervisors		34		48		96						
		Sector IEC Assistants		34		48		48						
		SOPS		1217		1712		1739						
		Team Leaders		301		426		436						
		Cell IEC Mobilizers		166		64		232						
		Village IEC Mobilizers		2494		945		3429						
		Security Guards		72		100		111						
		Washers		113		158		158						
		Pump Cleaners		0		0		150						
		Pump Technicians		4		6		6						
		Cleaners		3		5		6						
1.2.5	Number of VC project training workshops targeting NMCP and other host country staff	Total	1	2	1	2	2	0						
				Ento technicians		IRS District/Sect or Mngrs in 3 districts; MOPDD M&E Assistants								

#	Selected Indicators with Job Function Disaggregates	By Job Function	Annual Targets and Results									
			Year 1		Year 2		Year 3		Year 4		Year 5	
			Target	Result	Target	Result	Target	Result	Target	Result	Target	Result
1.2.6	Number of NMCP and other vector control host country staff who have logged into VectorLink Collect	Total	N/A	N/A	8	10	8	10				
		Vice Mayor				3		3				
		Health Director				3		3				
		MOPDD Staff				4		4				
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	Total	5225	4737	4301	4367	4328	3524				
		District IEC		2		2		3				
		Sector Coordinators		34		34		48				
		Sector IECs		68		34		48				
		Supervisors		61		54		108				
		M&E Assts		0		0		3				
		Environmental Compliance Asst		0		0		1				
		Adverse effect Coordinators		0		0		3				
		SOPs		1278		2312		2239				
		Team Leaders		301		438		436				
		Data Clerks				44		0				
		Storekeepers and Logistics		46		38		58				
		Spray Pump Technicians		0		0		6				
		Cell IEC Mobilizers		166		65		0				
		Village IEC Mobilizers		2494		934		0				
		Security Guards		72		100		113				
		Drivers		55		93		82				
Washers		113		158		159						

#	Selected Indicators with Job Function Disaggregates	By Job Function	Annual Targets and Results									
			Year 1		Year 2		Year 3		Year 4		Year 5	
			Target	Result	Target	Result	Target	Result	Target	Result	Target	Result
		Pump Cleaners		0		0		150				
		Clinicians		47		61		67				
1.4	Promote Gender Equality in all Facets of Planning and Implementation											
		Total		1312		1457		1893				
		Seasonal District Coordinator						1				
		District IEC Asst		1		2		1				
		Data Clerks		5		20		23				
		M&E Assistants		2		3		1				
		Data Cleaners		0		3		4				
		District Storekeepers		1		3		2				
		Sector Storekeepers		25		26		26				
		Logistics Assistants		2		4		3				
		Finance Assistants		1		2		4				
1.4.1	Number and percentage of women hired to support VC campaigns	Environmental Compliance Asst		0		0		0				
		Sector Coordinators		10		13		19				
		Sector Supervisors		14		23		53				
		Sector IEC Assistants		15		30		18				
		SOPs		729		891		863				
		Team Leaders		144		199		212				
		Cell IEC Mobilizers		53		14		69				
		Village IEC Mobilizers		231		112		418				
		Security Guards		3		4		0				
		Washers		73		104		105				
		Pump Cleaners		0		0		64				

#	Selected Indicators with Job Function Disaggregates	By Job Function	Annual Targets and Results									
			Year 1		Year 2		Year 3		Year 4		Year 5	
			Target	Result	Target	Result	Target	Result	Target	Result	Target	Result
		Pump Technicians		2		3		3				
		Cleaners		1		1		4				
1.4.2	Number and percentage of women hired in supervisory roles in target areas for VC activities	Total		240		303		334				
		Sector Coordinators		10		13		19				
		Sector Supervisors		29		23		53				
		Sector IECs		29		32		18				
		Storekeepers, Logistics		27		33		31				
		Team Leaders		143		199		212				
		M&E Assistants		2		3		1				
1.4.3	Number and percentage of trainees (permanent and seasonal) who have completed gender awareness training	Total	5115	4444 [1]	4444	2874	2305	2889				
		District IECs				2		3				
		Sector Coordinators				34		48				
		Sector IECs				34		48				
		Supervisors				54		108				
		M&E Assts				0		3				
		Environmental Compliance Asst				0		1				
		Adverse Effects Coordinators				0		3				
		SOPs				2312		2239				
		Team Leaders				438		436				
2.	Entomological and Epidemiological Data to Drive Decision-Making											
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	Total	N/A	N/A	4	6	0	2				
		Category/Function				MOPDD staff		MOPDD Data Managers				

#	Selected Indicators with Job Function Disaggregates	By Job Function	Annual Targets and Results											
			Year 1		Year 2		Year 3		Year 4		Year 5			
			Target	Result	Target	Result	Target	Result	Target	Result	Target	Result		
	vector control decision making													
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	Total Category/Function	N/A	N/A	4	6	0	2						
					MOPDD staff		MOPDD Data Managers							
3.	Procurement and Logistics													
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	Total	47	40	39	39	39	58						
		Central Warehouse Storekeeper		1		1		1						
		District Logistics Asst		2		2		3						
		District Storekeepers		3		2		3						
		Sector Storekeepers		34		34		51						

[1] Nearly all trainees were trained on gender awareness but the job function disaggregates are no longer available.

ANNEX B: ENVIRONMENTAL MITIGATION AND MONITORING REPORT

Mitigation Measure	Status of Mitigation Measures	Outstanding Issues Relating to Required Conditions	Remarks
<p>1a. Insecticide selection for any USAID-supported malaria program is subject to the criteria listed in the USAID Programmatic Environmental Assessment, country SEAs, and host country requirements.</p>	<p>The insecticides are approved for IRS use pursuant to the approved Programmatic Environmental Assessment and Supplemental Environmental Assessment, which is valid nationwide through 2021 and authorizes the use of the pyrethroid, carbamate, organophosphate, and neonicotinoid classes of insecticide.</p>	<p>No outstanding issues</p>	<p>The Supplemental Environmental Assessment was approved on 9/14/17. Fludora[®] Fusion is registered in country.</p>
<p>1b. Procurement and inventory logs must be maintained.</p>	<p>All procurement and inventory logs of Fludora[®] Fusion were maintained.</p>	<p>No outstanding issues</p>	<p>None</p>
<p>1c. Ensure storage facility and PPE are appropriate for the active ingredient used and in accordance with approved spray operators.</p>	<p>All storage facilities and PPE were selected based on the PMI BMP manual and conforming to requirements outlined in the Material Safety Data Sheets.</p>	<p>No outstanding issues</p>	<p>The storage facilities were premises provided by local authorities. PSECA's were carried out to confirm the readiness of each operations site.</p>
<p>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 spray operators/waste management plan).</p>	<p>Insecticides were distributed to facilities that can safely store and dispose of such commodities, and were chosen pre-season based on requirements outlined in the PMI BMP manual.</p>	<p>No outstanding issues</p>	<p>PSECA's were carried out in August 2020 to confirm the readiness of each operations site. An authorization meeting was held with the Home Office Environmental Compliance Manager to authorize insecticide deployment to operations sites that have met all the requirements.</p>

Mitigation Measure	Status of Mitigation Measures	Outstanding Issues Relating to Required Conditions	Remarks
1e. Pre-contract inspection and certification of vehicles used for pesticide or spray team transport.	Pre-contract inspection and certification of vehicles was conducted on August 23, 2020. In total, 75 vehicles were inspected and certified for use in the IRS campaign.	No outstanding issues	None
1f. Driver training.	All 75 hired drivers were trained before they were dispatched to districts.	No outstanding issues	PMI VectorLink oriented all drivers who had joined the IRS campaign on safety measures for transporting insecticides, accident and spills response procedures, and safe driving techniques.
1g. Cell phone, PPE, and spill kits on board during pesticide transportation.	All 75 drivers had cell phones as a prerequisite to their vehicles being rented. All were given a set of PPE to use when transporting insecticides and/or spray team members. Transportation vendors provided each vehicle with a first aid kit and spill management kit. A total of 2,058 vehicle inspections were conducted throughout the campaign.	No outstanding issues	Vendors stocked all vehicles with complete spill kits and first aid kits to last the whole spray campaign, after PMI VectorLink staff had emphasized this requirement for all vehicles.
1h. Initial and 30-day pregnancy testing for female candidates for jobs with potential pesticide contact.	All 1,131 females (spray operators, washers, squad leaders, supervisors, and store assistants) were given pregnancy tests before they were hired. The tests were done a week before the start of the IRS training in Nyagatare, Kirehe, and Ngoma districts.	No outstanding issues	None
1i. Health fitness testing for all operators.	All 2,675 spray actors received medical examinations (physical examinations, blood pressure) to determine their physical fitness for the project's demands.	No outstanding issues	All spray actors underwent a medical examination and those that were declared medically fit proceeded for training as spray team members.

Mitigation Measure	Status of Mitigation Measures	Outstanding Issues Relating to Required Conditions	Remarks
1j. Procurement of, distribution to, and training on the use of PPE for all workers with potential pesticide contact.	Both international and local procurements were completed before training began. The use of PPE was demonstrated during TOTs, cascade, and storekeeper training, before the spray campaign began.	No outstanding issues	All spray actors were fully trained on correct PPE use. This message was reinforced during morning mobilization.
1k. Training on mixing pesticides and the proper use and maintenance of spray pumps.	Training covered the correct mixing procedure for insecticides. The trainings demonstrated the proper use and maintenance of sprayers. Six sprayer technicians were then trained on how to repair major defects.	No outstanding issues	Team leaders were available to assist pump technicians in the field to ensure that faulty pumps were immediately replaced or fixed. If the defect was major, the pump technician was called.
1l. Provision of adequate facilities and supplies for end-of-day clean-up.	<p>VectorLink Rwanda upgraded 42 fixed soak pits to the size of 4x6 meters. In addition, 8 new fixed soak pits were constructed. A total of 50 fixed soak pits were used. Each IRS campsite had latrines and bathing facilities for both sexes. All facilities were compliant, and had the materials required for clean-up.</p> <p>A total of 1,939 end-of-day inspections were conducted.</p>	No outstanding issues	<p>Adequate water, barrels, wash basins, soap, and detergents were available at all times at each operations site.</p> <p>Washing facilities for both female and male spray operators and supervisors were provided at all campsites for total compliance.</p>
1m. Enforce spray and clean-up procedures.	End-of-day clean-up was done in designated wash areas and supervised by the ECO, PMI VectorLink IRS Coordinators, other PMI VectorLink staff, government district supervisors, and government central supervisors, PMI VectorLink staff and government supervisors inspected 48 sites, and a total of 1,939 end of day inspections were submitted. A total of 68 red flags regarding end-of-day clean-up were reported, but rectified immediately.	No outstanding issues	Observed cases of noncompliance were resolved immediately.

Mitigation Measure	Status of Mitigation Measures	Outstanding Issues Relating to Required Conditions	Remarks
<p>1n. IEC campaigns to inform homeowners of responsibilities and precautions.</p>	<p>The IRS IEC campaign was effectively carried out through in-person community mobilization before and during the spray campaign, and through radio adverts, hosted radio discussions, and printed materials (posters). The project used 3,661 mobilizers to conduct community mobilization and sensitization on IRS to inform homeowners what to do before, during, and after spraying.</p>	<p>No outstanding issues</p>	<p>Because of the rainy season, most householders are reluctant to remove all their possessions from their homes. However, most householders were convinced to adequately prepare their households because of strong mobilization teams.</p>
<p>1o. Prohibition of spraying houses that are not properly prepared.</p>	<p>Spray operators were advised not to spray in structures that were not properly prepared.</p>	<p>No outstanding issues</p>	<p>None</p>
<p>1p. Two-hour exclusion from house after spraying.</p>	<p>Spray operators were trained to inform homeowners that they must leave their sprayed homes closed for two hours and then open the doors and windows and wait another 30 minutes before entering and sweeping the structure and disposing of the swept-up material into the pit latrines or burying it. All 9,562 homeowner inspections revealed that spray operators had informed household owners about post-spray procedures.</p>	<p>No outstanding issues</p>	<p>The ECO, District Coordinators, and District Supervisors played a pivotal role in enforcing this requirement. No noncompliance issues were observed.</p>
<p>1q. Instruct homeowners to wash itchy skin and go to health clinic if symptoms do not subside.</p>	<p>Homeowners were instructed to wash their skin with plenty of water and soap if they experienced itching, and to visit the nearest clinic if the itching persisted. Out of 9,562 inspections, no incident of exposure was observed.</p>	<p>No outstanding issues</p>	<p>Most spray operators provided the required information to homeowners, but some homeowners forgot the instructions. However, these instructions were repeated by PMI VectorLink staff and government staff doing monitoring and supervision.</p>

Mitigation Measure	Status of Mitigation Measures	Outstanding Issues Relating to Required Conditions	Remarks
1r. Indoor spraying only.	The ECO, District IRS Coordinators, team leaders, and supervisors worked hard to ensure that all sprayable surfaces were sprayed, including the walls, ceiling, and eaves of all sleeping spaces. Of the 9,562 supervisory inspections conducted during the campaign, no cases of spray operators spraying outdoor surfaces or open spaces were observed.	No outstanding issues	None
1s. Training on proper spray technique.	Spray operators were trained on proper spray techniques during cascade training. The 9,562 inspections by the supervisors found only 7 instances of spray operator noncompliance.	No outstanding issues	Observed issues of noncompliance were resolved immediately.
1t. Maintenance of pumps.	Before the deployment of spray operators each morning, team leaders and supervisors serviced all spray pumps. In 9,562 inspections, supervisors found 169 leaking pumps. The pump technician, team leaders, and supervisors were readily available to repair the defective pumps so that spray operators could quickly resume work.	No outstanding issues	Leaking pumps were replaced or fixed immediately.
1u. No application of insecticides within 30 yards of beekeeping sites.	Spraying was done indoors only and at least 30 meters away from sensitive areas, including beehives.	No outstanding issues	None
2a. Choose sites for disposal of liquid wastes according to PMI BMPs.	Selecting the soak pit sites for liquid waste disposal was done out in accordance with the PMI BMP. This process was carried out by the ECO, ECA, Operations Manager, and district supervisors, and was supervised by the project Chief of Party. All operations sites were inspected to ensure that they met BMP standards before they were certified for use.	No outstanding issues	All sites selected were suitable for the disposal of liquid waste.

Mitigation Measure	Status of Mitigation Measures	Outstanding Issues Relating to Required Conditions	Remarks
2b. Construct soak pits with charcoal to adsorb pesticide from rinse water.	Soak pits were constructed in accordance with recommendations outlined in the PMI PMP manual. VectorLink Rwanda upgraded 42 fixed soak pits to the size of 4x6 meters washing area. Additionally, 8 new soak pits were constructed. A total of 50 soak pits were used.	No outstanding issues	None
2c. Maintain soak pits as necessary during season.	All 50 fixed soak pits were well maintained. All soak pits lasted throughout the spray campaign without any problems. Contaminated water drained properly into the soak pits.	No outstanding issues	None
2d. Inspection and certification of solid waste disposal sites before spray campaign.	VectorLink Rwanda, with support from REMA and the Environmental Health Officer from the Ministry of Environment, ensured that the sites for waste disposal were inspected to meet standards. VectorLink Rwanda will use the authority-approved incinerator to incinerate nose masks and contaminated cardboard boxes. Uncontaminated cardboard boxes will be recycled at the Rwandan local company Cards from Africa. Plastic sheets will be recycled at Kigali by the Rotassairwa recycling plant.	No outstanding issues	A waste management plan was developed before the spray campaign began.
2e. Monitoring waste storage and management during campaign.	All waste materials were stored and managed according to PMI BMPs during the spray campaign. IRS solid waste was separated into categories (paper, plastic, rubber, and cloth), and stored in labeled bags. Out of the 745 storekeeper performance inspections that were conducted, 148 red flags were observed.	No outstanding issues	The entire VectorLink Rwanda senior management team was in the field supervising IRS operations throughout the campaign, and was able to immediately identify and address any noncompliance issues.

Mitigation Measure	Status of Mitigation Measures	Outstanding Issues Relating to Required Conditions	Remarks
2f. Monitoring disposal procedures post-campaign.	The ECO will monitor the post-spray campaign solid waste disposal. All IRS waste has already been sorted, labelled, collected and transported to Kigali, and will be incinerated or recycled as per PMI BMP guidelines.	No outstanding issues	None
3a. Maintain records of all pesticide receipts, and issuance and return of empty sachets/bottles.	Stock cards tracked insecticide going to and from the central store, with back-up ledger books at the central, district, and sector stores. Out of the 745 storekeeper performance inspections that were conducted, four stock cards were found on which the end-of-day balance of empty bottles did not equal the opening balance in the ledger.	No outstanding issues	None
3b. Reconciliation of number of houses sprayed vs. number of sachets/bottles used.	The average number of structures sprayed per sachet of insecticide was 1.4; the previous year's average was 1.3 structures per bottle.	Falsification of data was observed and reported in two incidents in Nyagatare. Data collection verification and structure verification was carried out across the three districts; the final results and assessment are pending.	<p>Following two thefts, the decision was made to reduce the number of insecticide sachets issued daily to the spray operators, with supervisors being issued a buffer if there is need for additional insecticide. Field supervision was increased, and communication was provided to field teams to reinforce project protocols.</p> <p>For the upcoming campaigns, data collection verification will be integrated as part of routine supervision so noncompliance will be observed and rectified in a timely manner.</p>

Mitigation Measure	Status of Mitigation Measures	Outstanding Issues Relating to Required Conditions	Remarks
3c. Visual examination of houses sprayed to confirm pesticide application.	Visual examination of houses sprayed was conducted by team leaders, sector supervisors, and the Operations Manager, ECO, and Chief of Party. Traces of the sprayed chemical were observed on the walls, ceilings, and eaves during the visit. A total of 9,562 homeowner preparation inspections and spray operator performance were carried out.	No outstanding issues	Inspections was mainly done through a checklist, which included visual examination of sprayed walls, eaves, and ceilings. Minor noncompliance issues were observed and rectified immediately.
3d. Perform physical inventory counts during the spray season.	The ECO, District IRS Coordinators, and Logistics Coordinator conducted physical inventory counts during and after the spray season using the storekeeper performance inspection checklist. Out of the 745 storekeeper inspections conducted, 149 noncompliance issues were observed; these were rectified immediately.	No outstanding issues	Noncompliance issues were rectified immediately.
4a. Insecticide shipments over water	N/A	N/A	N/A