



ENVIRONMENTAL ASSESSMENT

1.1 PROJECT/ACTIVITY DATA

Project/Activity Name:	PMI VectorLink Project
Geographic Location(s) (country/Region):	Benin/Nationwide
Amendment (Yes/No), if Yes indicate # (1, 2...):	No
Implementation Start/End Date (FY or M/D/Y):	11/1/2017-September 2022
Solicitation/Contract/Award Number:	AID-OAA-I-17-00008 / AID-OAA-TO-I7-00027
Implementing Partner(s):	Abt Associates, Inc.
Bureau Tracking ID:	
Tracking ID of Related RCE/IEE (if any):	
Tracking ID of Other, Related Analyses:	Programmatic Environmental Assessment for Integrated Vector Management Programs for Malaria Control ¹ PNADI081

1.2 ORGANIZATIONAL/ADMINISTRATIVE DATA

Implementing Operating Unit(s): (e.g. Mission or Bureau or Office)	Global Health
Other Affected Operating Unit(s):	Africa Bureau
Lead BEO Bureau:	Global Health
Funding Account(s) (if available):	
Original Funding Amount:	
If Amended, specify funding amount:	
If Amended, specify new funding total:	
Prepared by:	Sana Diop Dieng / Peter J Chandonait
Date Prepared:	March 4 th , 2020

1.3 ENVIRONMENTAL COMPLIANCE REVIEW DATA

Analysis Type:	Environmental Assessment
Environmental Determination(s):	Positive Determination
Environmental Assessment Expiration Date:	5 years from approval date
Climate Risks Addressed (#):	Low <u> x </u> Moderate <u> </u> High <u> </u>

¹ <https://ecd.usaid.gov/repository/pdf/50060.pdf>

ENVIRONMENTAL ASSESSMENT APPROVAL

PURPOSE AND SCOPE OF THE ENVIRONMENTAL ASSESSMENT

The purpose of the Environmental Assessment is to provide Agency and host country decision-makers with a full discussion of significant environmental effects of a proposed action. It includes alternatives which would avoid or minimize adverse effects or enhance the quality of the environment so that the expected benefits of development objectives can be weighed against any adverse impacts upon the human environment or any irreversible or irretrievable commitment of resources.

The President's Malaria Initiative (PMI) is engaged in indoor residual spraying (IRS) of insecticide to kill the mosquitoes that transmit malaria. The use of insecticides in this manner has resulted in a Positive Determination from the Initial Environmental Examination. A Programmatic Environmental Assessment (PEA) has been completed and updated, most recently in 2017. The PEA mandates the preparation of a Supplemental Environmental Assessment (SEA) for each country in which PMI engages in IRS, and an update of the SEA every five years. This document represents the fulfillment of that requirement for Benin.

1. The Benin Supplemental Environmental Assessment (SEA) (2016), as amended in 2019 (amendment #1), was valid for implementing USAID-supported IRS in all areas of Benin for the period 2016-2020.
2. In order to continue with PMI IRS, PMI is seeking approval for a new SEA effective for five years (2020 - 2024), and for the SEA to be nationwide in scope.
3. This SEA will authorize the continued use of all WHO-recommended pesticides in the pyrethroid, carbamate, organophosphate and neonicotinoid classes, and also authorizes the use of chlorfenapyr when recommended by WHO Prequalification team (PQ).
4. In order to increase its current inventory of protected environments and habitats, the Government of Benin has been expanding its protected area network to meet the International Union for the Conservation of Nature standard for protected area coverage. Some of the new protected areas include villages and communes that have been or are now targeted for IRS. In general, and nearly exclusively, these communities are in buffer zones of the protected areas, and IRS is permitted in the buffer zones. This SEA contains the condition that spraying will not be performed by PMI IPs within 30 meters of natural water bodies, wetlands or marshes, organic farming areas, beekeeping areas, or the core areas within protected forests, parks or habitats.
5. It is further proposed to allow for small studies or hut trials to evaluate new IRS insecticides such as chlorfenapyr, once the insecticide has been submitted for Phase III PQ evaluation, and once the required country-level documentation has been submitted and/or registration is completed.
6. The Safer Use Action Plan provides detailed guidance on the performance of all activities associated with IRS. The attached, updated Environmental Mitigation and Monitoring Plan (Annex A) summarizes the key required mitigation measures, as well as the monitoring and reporting requirements and schedule.

7. The preparation of this SEA renders a Letter Report unnecessary for 2020. In subsequent years, provided there are no changes to the program outside the scope of this SEA, a Letter Report will be submitted to PMI annually that will discuss significant changes in the IRS program for that particular year's spray campaign.

BUREAU ENVIRONMENTAL OFFICERS FINDINGS AND SPECIFIED CONDITIONS OF APPROVAL

The USAID Global Health Bureau has determined that the proposed IRS effort, as described in this SEA, responds to the needs of the community and country with respect to managing malaria in Benin and also conforms to the requirements established in 22 CFR 216.

This document does not mandate the execution of the proposed IRS. Rather, it documents the environmental planning and impact analysis executed by the IRS team in preparation for the proposed action. The design and standards of operation of the IRS program were established to avoid and reduce any potential adverse impact. USAID has concluded that the proposed action, when executed as described in the SEA and the PEA for PMI IVM (2017), is consistent with the Government of Benin's and PMI's goal of reducing malaria incidence in Benin while minimizing negative impact to the environment and to human health.

The proposed actions recommended for approval in this 2020 SEA are:

1. The continuation of IRS implementation using pyrethroids, carbamates, organophosphates, neonicotinoids and the clothianidin/deltamethrin combination, and/or chlorfenapyr (when PQ-listed), where appropriate, based on criteria such as transmission rate, vector susceptibility, residual effect, appropriate home and wall structure, economic factors, and ecological/human health impacts.
2. This SEA will continue to provide coverage of all geographical areas, in Benin where IRS may be implemented or where PMI may provide national- or regional-level support as decided by the NMCP and PMI for the five-year period from 2020 – 2024.
3. This SEA authorizes small, closely supervised studies or hut trials to study new IRS insecticides such as chlorfenapyr, once the insecticide has been submitted for Phase III WHO PQ evaluation and Country-level required documentation has been submitted.
4. This SEA also authorizes small-scale construction of facilities such as storerooms, insectaries, wash areas, and soak pits, needed to perform IRS in a safe and effective manner.
5. Given the successful record of PMI in implementing IRS in Africa without significant environmental consequences, it is proposed to continue to allow IRS in the buffer zones of environmentally protected areas, using the strict protocols and procedures contained in the PMI best management practices (BMP) manual, and observing all precautions and prescriptions in this SEA.

The Safer Use Action Plan (section 6.1.1) for Benin provides detailed guidance on the performance of all activities associated with IRS. Through the use of this and other guidance, PMI has maintained an excellent record of success in executing IRS without substantial environmental or human health impact.

USAID APPROVAL OF ENVIRONMENTAL ASSESSMENT

PROJECT/ACTIVITY NAME: PMI VectorLink Benin Project

Approval:	<u>For [Signature] Brennan Sanders 3/16/2020</u>	
	Carl Anderson, Country Representative	Date
Clearance:	<u>[Signature] SB</u>	<u>03/16/2020</u>
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ENVIRONMENTAL ASSESSMENT

1.0 SUMMARY

This document has been prepared to serve as a Supplemental Environmental Assessment (SEA) for Indoor Residual Spraying (IRS) in Benin supported by the U.S. President's Malaria Initiative (PMI) for the period 2020 – 2024. This update was prepared in accordance with the provisions of Title 22 of the United States Code of Federal Regulations, Part 216 (22 CFR 216) regarding the use and application of pesticides. As required by the 22 CFR 216, only World Health Organization (WHO) Pre-Qualification (PQ)-listed pesticides are acceptable for IRS operations² supported by PMI. Previous United States Agency for International Development (USAID) environmental documentation for IRS in Benin authorized the use of WHO-recommended pesticides in the pyrethroid, carbamate and organophosphate classes nationwide including the chlorfenapyr in the pyrrole class (when PQ listed) from 2016 to 2020. In addition, an SEA Amendment was written and approved in April 2019 that authorized the use of neonicotinoid and a clothianidin/deltamethrin mixture. This SEA proposes to (re)authorize the use of the same six classes of insecticides, including the use of chlorfenapyr in the pyrrole class, when listed by WHO PQ. Additionally, the SEA seeks nationwide coverage of authorized PMI-supported IRS, and requests authorization of small-scale, closely supervised hut trials using new IRS insecticides, when the insecticide has been submitted for Phase III PQ evaluation, and country-level required documentation has been submitted and approved.

Malaria is a major public health problem in Benin with seasonal upsurge. Although dramatic progress in malaria control has been made in recent years with the scale-up of malaria prevention and treatment interventions, malaria transmission is stable but influenced by several factors including vector species, geography, climate, hydrography, rainfall, temperature.

With 2020 funding, PMI will continue to support IRS in up to six high-burden districts with an estimated number of structures of approximately 387,711 structures.

Changing or rotating insecticides of different classes over time is a leading way to manage vector resistance. In Benin, entomological monitoring has demonstrated that local mosquitoes were susceptible to pirimiphos methyl (mortality > 98%). However, these same vector populations showed a decrease in susceptibility to bendiocarb (mortality between 90 and 97%) (suspected resistance), except Kandi where mortality was 100% for those mosquitoes. For deltamethrin, *An. gambiae* s.l. was resistant in all the districts (mortality < 90%).

The 2019 amendment to include new insecticides was prompted by the need to increase the available options for IRS. Clothianidin, a neonicotinoid, was listed by the WHO PQ in 2017, and a combination clothianidin/deltamethrin product, Fludora® Fusion was listed in 2018. Chlorfenapyr, a member of the pyrrole chemical class, if listed by WHO PQ and authorized by the Ministry of Agriculture for use in Benin, would offer additional options for insecticide rotation. In 2020, Benin will conduct IRS with Fludora® Fusion, and the remaining stock of Actellic® 300 CS from the 2019 spraying campaign.

²Pre- Qualified list-Vector Control Products <https://www.who.int/pq-vector-control/prequalified-lists/en/>

This SEA for IRS in Benin outlines the monitoring and mitigation measures that the PMI IP will use to minimize or reduce any adverse impacts of pesticide application. Those measures are found in the Safer Use Action Plan (Section 6.1.1 and summarized in the Environmental Mitigation and Monitoring Plan in Annex A). All PMI IRS operations in Benin will be performed according to the protocols and procedures found therein. These procedures do not change with the use of different classes of authorized pesticides, with the following exceptions:

1. Deltamethrin, found in Fludora Fusion, is a skin irritant, and can cause parasthesia (an abnormal sensation, typically tingling or pricking (“pins and needles”), caused chiefly by pressure on or damage to peripheral nerves.). Spray operators must be cautioned against touching their skin, particularly their face, with contaminated gloves.
2. Due to the potential cumulative effects of organophosphate exposure (e.g., cholinesterase depression), team leaders and senior staff will need increased emphasis and training on their responsibility and ability to constantly monitor the appearance and behavior of their team members and to recognize the symptoms of organophosphate exposure in order to implement response protocols. Biomonitoring is not required for the use of pirimiphos-methyl formulations for IRS at the present time, but increased vigilance is essential.
3. Pirimiphos-methyl formulations are supplied in plastic bottles, which if not controlled carefully may be used inappropriately once emptied of the insecticide. In addition, incineration of the bottles may cause harmful emissions. Because of these potential problems, the following procedures and protocols have been established:
 - a. A triple rinse for the plastic bottles has been incorporated during the insecticide mixing procedure, whereby the insecticide container is emptied into the spray tank and then three times the bottle is partly filled with clean water, capped, shaken, and emptied into the spray tank. This ensures that the insecticide is used more efficiently, and that the container is thoroughly rinsed of pesticide and therefore safe for handling and subsequent recycling/use. The risk of exposure due to insecticide residue in the container is essentially eliminated; however, the following procedures are also followed.
 - b. Containers are punctured multiple times so no one can reuse them.
 - c. Recycling programs have been established to turn the plastic into usable non-food products. Through close supervision and chain of custody, and in partnership with the NMCP, the implementing partner will ensure that the plastic remains segregated from other supplies, is used for items such as oil tanks, patio flagstones or electrical conduit, and will not be used for products that contain consumables. The recycling programs have prevented the emission of many tons of carbon dioxide and other potentially toxic chemicals from the incineration of plastic.

The PMI implementing partner (IP) will implement the EMMP (section 6), with guidance from PMI and the NMCP and with the assistance and involvement of the local communities. All senior staff in charge of IRS implementation will be trained to monitor operations when in the field, in order to maximize supervisory oversight and ensure the effectiveness of the mitigation measures during spray operation. The Health zone coordinators will also monitor environmental compliance during the IRS campaign. The (IP) will complete the annual Environmental Mitigation and Monitoring Report Form and submit it to PMI along with the annual End of Spray Report.

This SEA obviates the need for a letter report in 2020, but normally a letter report will be submitted annually to the Contracting Officer's Representative (COR) and Bureau Environmental Officer (BEO) prior to the spraying campaign. It will contain information regarding program changes, entomological resistance monitoring results, and program response to those results. It will also state how the program will improve on any areas of deficiency.

The following assessment draws heavily on the Programmatic Environmental Assessment (PEA) for Integrated Vector Management (IVM), updated in 2017, and many other reference documents, as noted throughout this document.

1.1 PROJECT DESCRIPTION

The focus of this project is to reduce the morbidity and mortality of malaria and other vector borne diseases, by implementing IRS and integrated vector control activities. The expected duration of the project is August 2017 – August 2024 and the approximate project funding amount is \$471 million.

Launched in 2005, the goal of the U.S. President's Malaria Initiative (PMI) is to reduce malaria-related deaths by 50% in high-burden countries in Africa through rapid scale-up of four highly effective malaria prevention and treatment measures to the most vulnerable populations: pregnant women and children under five years of age (USAID 2005). These interventions include ITNs, indoor residual spraying (IRS) with insecticides, intermittent preventive treatment for pregnant women, and prompt diagnosis and treatment with use of artemisinin-based combination therapies.

The U.S. President's Malaria Initiative (PMI) VectorLink Project was awarded to Abt Associates on September 30, 2017. The purpose of the project is to support PMI in planning and implementing indoor residual spraying (IRS) programs and other proven, life-saving malaria vector control interventions with the overall goal of reducing the burden of malaria in Africa. Building upon the IRS campaigns and entomological monitoring activities implemented under the PMI Africa Indoor Residual Spraying (AIRS) project, in Year 1, PMI VectorLink added IRS campaigns in Uganda, Burkina Faso, and Malawi for the first time.

In Year 2, the project continued to work in 24 PMI countries and one USAID malaria-focus Benin for a total of 25 countries. In addition to the IRS-centric nature of this project, additional activities included expanded entomological monitoring, continued technical support to insecticide-treated net (ITN) campaigns and durability monitoring, pilot and scale-up of new IRS products, and visualizations using epidemiological, entomological, and coverage data to determine the best application of available vector control tools within each Benin context.

In Year 3, PMI VectorLink will continue to carry out vector control activities in 25 countries and will also ramp up operational research activities in Colombia for a total of 26 countries. Some of the highlights of proposed core-funded 2020 activities include: a) continued standardization of procedures, processes, and tools for planning and implementation of IRS activities in the field, b) regional trainings for entomological surveillance, laboratory analysis, environmental compliance, and M&E (VectorLink Collect IRS and entomology instances), c) an enhanced curriculum for community-based entomological surveillance, d) technical assistance for ITN mass and continuous distribution (CD) campaigns, and durability monitoring studies, and e) VectorLink Collect entomological program finalization and deployment.

The VectorLink project will continue to work closely with Ministries of Health (MOH), National Malaria Control Programs (NMCP), district health offices, local non-governmental organizations, and community leaders to ensure that government, the private sector, and communities are able to sustain and lead future IRS and malaria control programs in their respective countries.

1.2 PROJECT CONTEXT

Global Burden of Malaria. Malaria is responsible for a tremendous health and economic burden in sub-Saharan Africa and Southeast Asia. Global annual cases stand at 214 million and deaths at an estimated 438,000³, of which 90% are in Africa and 85% are children under five. The economic burden of malaria is high, falling heavily on poor, rural populations. Malaria exacerbates the impacts of HIV/AIDS and interferes with educational attainment, and thus has effects lasting beyond the illness itself. However Benin experienced a reduction in the incidence and lethality of malaria from 17% to 14.6% and from 1.4 to 0.8%, respectively, a decrease of 14% in incidence and 43% in lethality.

Benin, like most countries in sub-Saharan Africa, recognizes malaria as the leading cause of mortality and morbidity. According to the Benin Health Statistics Yearbook (SNIGS 2016), malaria is the leading cause of consultation (42.8%) and hospitalization (52.3%). In children, malaria is also the leading cause of hospitalization with 52.4% of cases recorded in Benin⁴.

USG Commitment to Malaria Vector Control. Malaria prevention and control is a major foreign assistance objective of the U.S. Government (USG). The President's Malaria Initiative (PMI), which was launched in June 2005, represented a major expansion of USG resources for malaria control. Based on the 2008 Lantos Hyde United States Leadership against HIV/AIDS, Tuberculosis, and Malaria Act, PMI's goal was broadened to achieve Africa-wide impact by halving the burden of malaria in 70 percent of at-risk populations in sub-Saharan Africa. Under the PMI Strategy for 2015-2020, the USG's goal is to work with PMI-supported countries and partners to further reduce malaria deaths and substantially decrease malaria morbidity, towards the long-term goal of elimination. Preventive methods (indoor residual spraying and long-lasting insecticide treated nets) are two main interventions supported by PMI and are a critical component of PMI's strategy. PMI's Strategy fully aligns with the USG's vision of ending preventable child and maternal deaths and ending extreme poverty. PMI currently includes 19 focus countries in Africa and two focus countries and a regional program in the Greater Mekong Sub-region of Southeast Asia. PMI is an interagency initiative led by the U.S. Agency for International Development (USAID) and implemented together with the U.S. Centers for Disease Control and Prevention (CDC) of the U.S. Department of Health and Human Services (HHS)⁵.

1.3 SUMMARY OF 22CFR216 REQUIREMENTS (E.G., IEE AND THRESHOLD DETERMINATION)

The President's Malaria Initiative (PMI) is engaged in indoor residual spraying (IRS) of insecticide to kill the mosquitoes that transmit malaria. In 2007 a PEA was developed for USAID-funded IRS

³ World Health Organization. 2015. World Malaria Report: 2015.

http://apps.who.int/iris/bitstream/10665/200018/1/9789241565158_eng.pdf

⁴ 2017 – 2021 Benin NMCP National Strategic Plan

⁵ www.pmi.gov

“to serve as an umbrella evaluation of the environmental and human health issues related to malaria vector control and to assist with the preparation of country and activity specific SEA and PERSUAP for malaria vector control programs. It provides USAID project managers with the policy, procedural and technical guideline to choose appropriate interventions and insecticides and develop and implement mitigation and monitoring and evaluation activities.” The PEA requires the preparation of an SEA for each country in which support will be provided for the use of IRS. This SEA represents fulfillment of that requirement in the PEA for Benin. The PEA was updated in 2012 and 2017.

Prior to the award of the VectorLink project, an IEE was written and approved that reflected the broad scope of vector control efforts, to include insecticide-treated nets, larvicides, and personal repellents. The IEE was amended in 2019 to include small-scale construction.

The use of insecticides for IRS has resulted in a Positive Determination from the Initial Environmental Examination. US regulation 22 CFR 216.3(b) requires that when “a project includes assistance for procurement or use, or both, of pesticides, “that the Initial Environmental Examination or subsequent Environmental Assessment address the following 12 factors:

- a. The EPA registration status of the requested pesticide
- b. The basis for selection of the requested pesticide
- c. The extent to which the proposed pesticide use is part of an IVM program
- d. The proposed method or methods of application, including availability of appropriate application and safety equipment
- e. Any acute and long-term toxicological hazards, either human or environmental, associated with the proposed use and measures available to minimize such hazards
- f. The effectiveness of the requested pesticide for the proposed use
- g. Compatibility of the proposed pesticide with target and nontarget ecosystems
- h. The conditions under which the pesticide is to be used, including climate, flora, fauna, geography, hydrology, and soils
- i. The availability and effectiveness of other pesticides or nonchemical control methods
- j. The requesting country’s ability to regulate or control the distribution, storage, use and disposal of the requested pesticide
- k. The provisions made for training of users and applicators
- l. The provisions made for monitoring the use and effectiveness of the pesticide.

This SEA addresses these twelve factors.

1.4 MAJOR CONCLUSIONS OF SCOPING PROCESS

- IRS has been demonstrated to be an effective malaria prevention method.
- The Ministry of Health, and in particular the National Malaria Control Program is an essential partner in the planning, execution, and performance of IRS
- IRS can be performed safely if established mitigation measures are incorporated, and if there is a strict supervisory regime instituted.

- Local populations in general recognize the value of IRS, and are willing participants in the process.
- Sensitive activities and areas such as organic farming, endangered species habitat, bee-keeping and susceptible water resources must be identified and protected from potential negative impacts through the use of mitigation methods, strong supervisory oversight, and responsible waste management.

1.5 AREAS OF CONTROVERSY (IF ANY)

One area of limited controversy concerns the conduction IRS in areas where organic agriculture is practiced. Organic farmers are concerned that IRS insecticides could reach and contaminate their fields, invalidating their organic status and resulting in economic loss. To prevent this occurrence, the project has instituted a minimum buffer zone of 100 meters from organic fields, within which IRS will not be performed. This distance may increase in accordance with national or local legislation, but will not decrease.

Another frequently noted area of controversy is the mistaken belief on the part of beneficiaries that IRS attracts household pests, especially bedbugs. This belief is based on the increased appearance of the pests after IRS is performed, but it is more likely that IRS drives the pests out of their hiding places, according to several health officials interviewed.

1.6 ISSUES TO BE RESOLVED

Areas employing organic agriculture need to be carefully investigated on a case by case basis, bringing in stakeholders and regulatory officials to discuss and decide where IRS is appropriate, what size of buffer zone is required, and what other mitigation measures might be required. Information, education, and communication programs that precede IRS must include information relating to household hygiene to avoid the appearance of bedbugs.

2.0 PURPOSE

The goal of the PMI project is to reduce the burden of malaria in project countries. The USAID Global Health Bureau has determined that the proposed IRS effort, as described in this SEA, responds to the needs of the community with respect to managing malaria in project countries, and also conforms to the requirements established in 22 CFR 216.

2.1 PROJECT DESCRIPTION

The VectorLink project organizes IRS campaigns, coordinating with national and sub-national Ministry of health personnel to recruit, train, and supervise spray operators to apply long-lasting insecticides to the inner surfaces of homes in order to kill the mosquito vector that carries malaria. The project also carries out supportive activities such as entomological monitoring and consolidation of epidemiological, entomological and spray data to inform operations. The expected duration of the project is August 2017 – August 2024 and the approximate project funding amount is \$800 - \$900 million. This SEA is a critical element of a mandatory environmental review and compliance process meant to achieve environmentally sound activity design and implementation.

2.2 PURPOSE AND NEED FOR THE PROPOSED ACTION

The focus of this project is to reduce the morbidity and mortality of malaria and other vector borne diseases, by implementing IRS and integrated vector control activities (inclusive of ITNs), larval source management, and procuring/distributing personal repellents. The need for the project is evident from the health data indicating malaria incidence and prevalence, and the negative consequences to health, well-being, and the economy of Benin.

2.3 HOST COUNTRY CONTEXT

From an administrative point of view, the country is divided into 12 departments which are subdivided into 77 municipalities. These municipalities are further subdivided into 546 districts subdivided into their turn, into villages or city districts.

To better coordinate the fight against malaria, Benin has developed several five-year strategic malaria plans under the “Roll Back Malaria” initiative: 2001-2005, 2006-2010, 2011-2014 and the revised 2014-2018 NSP. The NSP 2017- 2021 was developed after the evaluation of the NSP 2014-2018 and incorporates the global objectives for malaria control over the period 2016-2030.

This Strategic Plan, based on the Malaria Control Policy, aims to achieve universal coverage of malaria prevention and management interventions for the period 2017-2021. It is intended as a reference framework and guidance tool for all actors and partners already involved or likely to be involved in the execution of activities. In this context, the plan aims to create the conditions that can make a significant contribution to improving the health of the population.

Benin, like most countries in sub-Saharan Africa, recognizes malaria as leading cause of mortality and morbidity. In 2017, according to the Benin Health Statistics Yearbook, 2016, malaria was the leading cause of consultations (44%) and hospitalizations (31%).⁶ The project’s goal for 2020 is to meet PMI’s objective of covering at least 85 percent of eligible structures found in all communes/districts targeted for spraying.

The main objectives of the project for the 2020 IRS campaign are as follows:

1. Strengthen the capacity of seasonal spray campaign supervisors and government officials in monitoring/supervision of IRS activities
2. Strengthen the National Malaria Control Program’s (NMCP) capacity in entomological and environmental compliance monitoring
3. Ensure that teams carry out high quality spraying on time, before the peak transmission season
4. Collect, analyze and disseminate routine epidemiological and entomological data in the high burden malaria areas, in partnership with the NMCP.

A workshop led by the MoH/NMCP and including several key partners such as PMI and Global Fund recommended that three districts of Donga department (Copargo, Djougou, Ouake) and three districts in Alibori department (Kandi, Gogounou and Segbana), which were targeted in 2019, will be targeted again for the 2020 spray campaign, using Fludora® Fusion, a

⁶ 2017 – 2018 Benin Demographic and Health Investigation

neonicotinoid/pyrethroid combination. In addition another recommendation from the workshop was to include structures not traditionally sprayed in past campaigns, such as boarding schools, orphanages and prisons with the remaining stock of organophosphate (Actellic® 300 CS) from 2019 IRS campaign. The 2020 IRS campaign is scheduled to begin on April 6 in all 6 districts.

2.4 SUMMARY OF ENVIRONMENTAL SCOPING PROCESS

The scoping process for this SEA included a desk review of available country data, including data generated from past campaigns, as well as HMIS data from country sources. In addition, a short-term technical assistance visit was made to Benin by the VectorLink Regional Environmental Compliance Manager to visit with and solicit input from relevant Benin entities such as the Ministries of Health, Environment, and Agriculture. Relevant laws and regulations were researched and documented, to ensure knowledge of and compliance with host country requirements. Visits were made to representative ecosystems in Benin, in order to understand the physical environment where IRS will take place. Potential physical facilities for hosting IRS operations were inspected to ensure that safety, security, and environmental requirements could be met. Finally, provincial, district, and local officials were interviewed in order to gather information about the success or shortcomings of previous interventions, so that plans could be made to simulate that success or to overcome any shortcomings.

2.5 STAKEHOLDER ENGAGEMENT AND HOST GOVERNMENT CONSULTATIONS

Representatives from the Ministry of Health, Environment, and Agriculture were interviewed at both the national and local levels. Local officials were interviewed and queried to determine what has worked and what has not been as successful in the past, in order to design a more successful and efficient project. Waste management facilities were visited and evaluated for their capabilities and to determine their usefulness. All major entities involved in complementary activities were contacted in order to establish cooperation and partnerships.

3.0 AFFECTED ENVIRONMENT (SOCIAL, PHYSICAL, BIOLOGICAL)

3.1 POPULATION CHARACTERISTICS⁷

3.1.1 SIZE

In the 5th General Census of Population and Housing (RGPH5), the population of Benin was estimated at 11,884,127 inhabitants in 2019 with a natural increase rate of 6.7% from 2018. Benin has a land area of 114,763 square kilometers. The population is unevenly distributed between the departments of North and South. With a population density of 87.2 inhabitants/km², the population is predominantly rural. However, 44.6% of the population lives in urban areas.

⁷ Institut National de la Statistique et de l'analyse Economique (INSAE) of Benin ; <https://www.insae-bj.org/>

3.1.2 ETHNICITY

In Benin the census of the population indicates that there are about 60 ethnic groups with their native languages. Traditionally, these various ethno-linguistic groups live quite compartmentalized and have culturally evolved in a different ways. Today, the borders of the country's cultural areas no longer coincide with those of the languages spoken and several distinct languages co-exist in places that are considered as belonging to a single community with its own specific language.

Nine major ethnic groups may be distinguished from the 60 ethnic groups, based on the similarity of languages, cultures and geographical configuration, with nine native language groups usually spoken within the household. Overall, the groups retained the same proportions of the population at the national level between the 2002 and 2013 censuses. However, the relative demographic proportions of Batonum (9% to 10%) and Peulh (7% to 10%) increased slightly between the two censuses, while the Yoruba (14% to 12%) and the other ethnic groups (2% to 1%) saw their relative numbers decrease in 2013 compared to 2002.

3.1.3 GENDER

The population distribution by sex and age shows a young and female-dominated population. Although there are more boys than girls born (103 boys per 100 girls), the Beninese population is predominantly female: 52% of women and 48% of men. The higher male mortality, especially at birth, where the difference is 5 years (4.4 years) and the migration phenomenon of men seeking well-being, shift the population makeup toward more women than men.

3.1.4 AGE DISTRIBUTION

The breakdown of this population by major age groups shows that those under 15 years represent 48%, those aged 15 to 60 make up 45.1% and the over-60 demographic represents only 4.2%. This breakdown shows the youth of the Beninese population, but the proportion of older people is increasing. The high proportion of youth in Benin, a guarantee of the dynamism of the population, also poses a major challenge in terms of health, education, recreation and jobs.

3.1.5 SOCIOECONOMIC STATUS AND CHARACTERISTICS

Benin's economic activity is constituted by 3 predominant sectors. These are the primary sector, which is the most important, representing the agriculture and processing industries; secondary sector, representing industry; and tertiary sector, directly and indirectly related to import and export activities. When the secondary sector is in timid development, Benin's economic activities are dominated by the primary and tertiary sectors. The agricultural sector is a vital sector for the Beninese economy as a source of wealth creation. It employs 70% of the working population, contributes 36% to the national gross domestic product and generates 88% of export earnings and 15% of the state's revenues. Benin's economy relies heavily on trade with Nigeria.

In order to contribute effectively to the achievement of the Sustainable Development Goals, the Government of Benin has included in its Program of Action of the Government (PAG) 2016-2021, the development of agriculture as an important axis.

This choice will result in the creation of seven agricultural development clusters and the promotion of six key agricultural sectors: cotton, maize, rice, pineapple, cassava and anacardia.

3.1.6 DESCRIPTION OF PROJECT BENEFICIARIES

The PMI VectorLink Project is a multi-sectorial approach fighting against malaria which primarily benefits sensitive populations such as women and children living in areas with a high burden of malaria.

3.2 PUBLIC HEALTH STATUS

The mission of the Ministry of Health is to design and implement the state policy in the field of health in accordance with the laws and regulations in force in Benin as well as government policy and vision. The vision of the Ministry of Health is to ensure that: "in 2025, Benin has a functioning health system based on public and private initiatives, individual and collective, to offer permanent availability and quality of care, equitable and accessible to populations in all categories, based on values of solidarity and risk sharing to meet all the health needs of the people of Benin."

To implement this vision, the Ministry of Health has five (5) strategic areas as shown in the Summary of the National Health Policy. Development strategies in the health sector according to the National Plan for Health Development 2009 - 2018 are as follows:

- Strategic Area 1: Reduction of maternal and infant mortality, prevention, fight against the disease and improve quality of care.
- Strategic Area 2: Human resource development.
- Strategic Area 3: Strengthening partnership in the sector and promoting ethics and medical ethics.
- Strategic Area 4: Improvement of the financial mechanism of the sector.
- Strategic Area 5: Strengthening sector management.

The mid-term evaluation of the National Development Strategic Plan of the Government of Benin noted that, despite the progress made in the various areas, there are still shortcomings to be noted by the Beninese health system in certain areas, such as:

- Governance and Leadership
- Health Human Resources
- National Health Information System
- Technical platforms for quality care
- Health sector funding
- Health products, medicines, medical supplies and vaccines
- Provision of services and care

3.3 GEOGRAPHIC CHARACTERISTICS

Benin is a narrow, rectangular shaped country situated in West Africa. Benin has a 100-kilometer coastline along the Bight of Benin, in the Atlantic Ocean. The country is bordered to the west by

Nigeria, to the north by Niger and Burkina Faso, and to the east by Togo. Both the capital, Porto-Novo, and Cotonou, the largest city, are located on the coast in the southeast of the country.

The relief of the country is somewhat uneven. Five natural regions stand out, namely: a coastal region, which is a sandy area bordered by lagoons; the "Bar Earth" composed of clay iron and marshy plains; a plateau of silico-clay with a grassy savanna stretching from North Abomey to peaks of the Atacora; the mountainous regions of the Atacora with an elevation reaching an altitude of 800 meters at its highest point, constituting the water reservoir of Benin and Niger; and the plains of Niger, which represent a vast fertile land and clay.

Benin is predominantly flat in topography, however there is substantial rigorous terrain as you travel northwards. There are five notable topographical regions:

- A Coastal Band; low and sandy, mostly surrounded by lagoons (and coconut palms);
- A Central Plain; hilly and monotonous, which rises gradually from 200 to 400 m from south to north around Nikki then descends to the Niger valley and Kandi Basin; The Kandi Basin Northeast is a plain drained by Sota River and its tributaries, which flow in very flared valleys;
- The Atacora chain in the Northwest, Mount Aledjo (658m) is the highest peak;
- The vast plains of Gourma in the extreme northwest, between Atakora and the border with Burkina Faso and Togo.
- The Wet Savannah occupies most of the country. Some primary forest patches remain in the south and center. Aquacultures, swamps and huge palm plantations predominate the southernmost part of Benin territory.

The beaches along the coast are sandy and dune ridden, dotted with small mangrove stands in the lagoons in and around the Lake Nokoue. This usually is described as a swampy strip, inundated during the rainy seasons and measuring up to 5 km in width, surrounded by the lagoons and extends along the entire coast immediately to landward of the low coastal dunes. Zones of periodic inundation extend inland from this strip, up minor streams for distances of up to 23 km, while swamps occur around the several small lakes on the coastal plain, and extensive swamps occur in the delta of the Oueme River, on the Couffro River at the head of Lake Aheme, and on the lower course of the Mono River.

On the interior plateau, in the central eastern district, extensive permanent swamps occur in the headwaters of tributaries of the Okpara River, some 50 km east of Parakou. In the northeast, floodplains and permanent swamps occur all the way along the Niger River where it forms the boundary between Benin and Niger. In the northwest, floodplains and permanent swamps occur on the Pendjari River and many of its influents, both to the east and west of the Atacora Mountains.

3.4 LAND USE CHARACTERISTICS

The agricultural sector is one of the key links in Benin's economy. It employs 70% of the working population, contributes 36% to the national Gross Domestic Product and generates 88% of the country's export earnings and 15% of its revenues.

Agricultural production is concentrated around two categories of crops: food crops which are cereals (maize, sorghum, millet and rice), roots, tubers (manioc, yam, sweet potato, potato, taro, etc.), legumes (beans, cowpea, soya and voandzou) and oilseeds (groundnuts, palm nuts, etc.), while cotton and oil palm are the main cash crops, along with anacardiac and pineapple. The production of these staple foods is largely dependent on climatic conditions. Eight agro-ecological zones have been classified on the basis of relative homogeneity, with consideration of climatic, agro-soil, cropping systems, population density, cover plant and certain other factors.

- **Zone of the extreme north of Benin (Zone 1):** It marks the northern boundary of Benin by the presence of the Niger River and its three tributaries: Mékrou, Alibori and Sota. It is an area that contains, in its majority, the forest reserve called National Park W. Its climate is of the Sudo-Sahelian type and includes the communes of Malanville and Karimama. Temperatures are excessive and reach 40°C in the shade during the dry season.
- **North Benin cotton zone (Zone 2):** Its name is based mainly on its specialization in cotton cultivation, a factor in the spectacular development of the communes it groups: Banikoara, Kérou, Kandi, Ségbana, Gogounou. This area is watered by the same tributaries of the Niger River as Zone 1 and is influenced by the continental Alizé, which is already foreseen in November.
- **South Borgou food zone (Zone 3):** This zone is characterized mainly by a very high availability of agricultural land, which is a major asset for food security. It comprises the municipalities of Nikki, Perere, Kalalé, Bembèrèkè, N'Dali, Sinendé, Péhunco and Kouandé. It is the area of the wet Sudanese climate marked by a rainy season from April to September and a dry season that lasts almost five months.
- **Zone Ouest-Atacora (Zone 4):** It is perhaps still designated by the foothills of the Atacora and includes the municipalities of Tanguiéta, Cobly, Matéri, Toucoutouna, Boukoubé, Copargo, Ouaké and Djougou. This area benefits from the presence of the Atacora Chain which gives it a particular climate where temperatures are cooler and thunderstorms more frequent than in other areas. The amount of rain varies from 800 to 1350 mm depending on the year. The main river is the Pendjari with its tributaries.
- **Central Cotton Area (Zone 5):** This area is the largest and contains the whole hills department and part of some departments (Borgou, Donga, Couffo, Plateau and Zou). It is an area conducive to agriculture and welcomes agricultural colonizers who have come for the most part from Zone 4. It is watered by the river Ouémé and its tributaries (Zou and Okpara).
- **“Bar Earth” Zone (Zone 6):** This zone is one of the most complex and referred to as “Bar Earth Zone” due to the characteristics of these soils. It is located in the southern part of Benin and includes the communes of Abomey-Calavi, Allada, Kpomassè, Tori-Bossito, Zè in the department of the Atlantic, Djakotomey, Dogbo, Klouékanmè, Houyogbé, Toviklin in the department of Mono, Adjarra, Akpro-Missérete, Avrankou, Ifangni, Porto-Novo, Sakete, in the department of Ouémé, Abomey, Agbangnizoun, Bohicon, Covè, Za-Kpota and Zagnanado in the department of Zou. The climate is marked by two rainy seasons (March-July; October-November) and two dry seasons (December-February; August). Rainfall heights range from 1000 to 1400 mm.
- **Depression Zone (Zone 7):** So called because it is located in a depression which, from West to East, is called Tchi depression in the Mono (Lalo Commune), Lama depression in the Atlantic and Zou (respectively Toffo and Zogbodomey Communes) and Issaba in

Ouémé (Communes of Adja-Ouèrè and Pobè). It is the smallest of the eight agro-ecological zones in terms of area. From a climatic point of view, it is quite comparable to the area of the bar lands with, however, high humidity, about 85%.

- **Fisheries Zone (Zone 8):** One of the main characteristics of this zone is the development of continental and maritime fishing in addition to plant and animal production. Geographically, it is the most southern and occupies the fluvio-lacustrine zone of the Atlantic, Mono, Ouémé and Zou departments where it covers the municipalities of Athiémé, Grand-Popo, Bopa, Lokossa, Comè in the Mono department, Ouidah and Sô-Ava in the Atlantic department, Sèmè-Kpodji, Aguégués, Dangbo, Adjohoun and Bonou in the Ouémé department and Ouinhi in the Zou department.. There are numerous small agricultural impoundments in the interior and northern parts, and a major dam on the Mono River, at Nangheto in Togo

3.5 CULTURAL OR HISTORIC RESOURCES

The Ramsar Site of the Complexe W (895,480 hectares) is a very large wetland complex comprising the W Benin National Park and related protected areas along the national borders with Burkina Faso and Niger, much of which is part of the UNESCO Man and Biosphere Transboundary Biosphere Reserve called "'W' Region". The 'Zone humide de la rivière Pendjari (144,774 hectares), also a National Park and a UNESCO Biosphere Reserve, is one of the most important humid ecosystems in the sub-Saharan zone of West Africa, characterized by gallery forests, savannah and swampy meadows, alluvial plains, ponds, rivers, and dense dry forests within floodplains.

In the past, hunting was regulated by myths and totems at the level of each clan; each animal was the totem of a clan and therefore was not supposed to be killed or consumed. The introduction of foreign beliefs has largely dispelled these totems and myths. Nearly a third of households (31.7%) own animals, 57% of them in rural areas, 36% in urban areas and 7% in Cotonou. They are more numerous in Alibori (64.6%), Atacora (56.1%), Couffo (61.3%) and Borgou (47.3%).⁸

3.6 ENVIRONMENTAL BASELINE INFORMATION

3.6.1 CLIMATE AND CLIMATIC PATTERNS (HISTORIC, CURRENT, AND PREDICTED)

Benin is located in West Africa on the Guinea Coast. At latitudes of 6 to 13°N, the climate of Benin is tropical, and strongly influenced by the West African trade winds.

There are two climatic zones in Benin; Southern and Northern. The Southern climatic zone has an equatorial type of climate which has two seasons – wet and dry – with each season occurring twice in a year. The dry (and hot) seasons occur from January to April and during the month of August. The rainy seasons occur from May to July and then September to December. The average monthly temperature in southern Benin ranges from 20° to 34° Celsius. The amount of rain increases rapidly in east. Sea breezes temper the climate during much of the year. In the Northern climatic zone, the wet and dry seasons occur only once. The dry (and hot) season occurs

⁸Republique du Benin Analyse Globale de la Vulnérabilité et de la Sécurité Alimentaire (AGVSA) ; Nov 2017

between November and June, with the cooler and very wet weather between July and October. These areas experience highly elevated temperatures during dry season.

June is the wettest month in all districts in Benin. Cotonou, its metropolis, and the coast is broadly hot and humid during this time. In the dry season, the Harmattan (hot dry wind from the northeast or east of Sahara) blows from December to March creating a haze over the city. On average about 890 mm (about 35 in) of rain falls yearly in northern Benin, mainly from May to September.

Benin is characterized by unusually dry conditions. This is due primarily to two very important factors. First, the situation of the coast which is rather well protected from the western winds; second, the Atacora Barrier in the West and North West which decreases the amount of rainfall.

Rainfall patterns vary all over Benin. Benin's rainfall azonality is remarkable, given the difference that is observed between the North and the South. The total average rainfall levels per annum fall symmetrically into the following two patterns: High rainfall level in the North-west (Djougou and Atacora) and South-east (Porto-Novo, Oueme and surrounding areas) -(1 500 – 1 400 mm); and Low rainfall level in the North and North-east (the Niger valley) and low Mono valley in the South-west (1 000-850 mm).

Within these two extreme regions is a vast area including the Zou, Middle Ouémé and Central Borgou basins where annual average rainfall levels oscillate between 1 100 and 1 200 mm. The configuration of the annual isohyets shows an indigent rainfall zone located in the areas bordering the sea which extends diagonally inland towards the SW-NE in a downward curve.

Benin is characterized by the following two rainfall gradients; a littoral gradient extending from Sèmè (1 500 mm) towards the "thalweg" of the diagonal on the Grand-Popo-Bopa-Zagnanado axis, and a Northern sub-meridian gradient extending from Djougou to the piedmont south-east of the Atacora mountain range (1 400 mm), towards Malanville in the Niger valley (900 mm). Between the 7° 30 ' and 9° parallels, a rainfall "marsh" extends with some localised "poles" onto the inselbergs (island-mountains) of the Idaca – Cabè country.

3.6.2 AIR

The VectorLink project is not expected to impact air resources to any appreciable degree.

3.6.3 WATER RESOURCES

Benin has a narrow 125 kilometer coastline along the Bight of Benin, in the Atlantic Ocean, and an area stretching 50-69 km inland from the Atlantic Ocean that covers about eight percent of the country's land area, but harbors 50 percent of the population. The ecological functions and the natural and biological processes that take place at the interface between the rivers, lagoons, lakes and swamps, on the one hand, and the marine areas on the other, make the Benin coastal zone one of the more productive of the Gulf of Guinea. In particular, water bodies in the coastal inland harbor important and unique biodiversity assets.

3.6.4 GROUND WATER

Benin has a diverse and dense network of surface and underground water resources and basins that form the hydrological network described in detail in the section below. Four large sets of water basins exist in Benin including: the Niger basin, hydrographic basins of the Volta, coastal

watershed basin including west of Mono-Couffo and all of the Ouémé-Yéwa basin. The entire coastal watershed empties into a lagoon system that connects the two Western sets of basins.

3.6.5 SURFACE WATER

- **Lakes :**

- Lake Nokoué is a lake in the southern part of the West African nation of Benin. The lake is 20 km wide and 11 km long and is located, north of Cotonou. On the northern edge is the famous water town of Ganvié. Lake Nokoué is an important site for the birds.
- Lake Nokoué, which is South of the Oueme Valley, is connected to the sea through the Cotonou Channel (Cotonou lagoon) which separates the eastern and western parts of the town. Otherwise, the Lake Nokoué is surrounded by a system of lagoons and shallows to which it was initially connected, and which presently are shut off from one another due to the urban development. The fluctuations of the lagoon water levels are related not only to the rainfalls but also to the groundwater dynamics depending on the hydraulic continuity existing among them.

- **Rivers**

- **Ouémé River** is Benin's longest fluvial basin (length: 510 km, surface: 50,000 km²). It springs out of the Tanéka hills (about 9°51' NS) in the Atacora Mountains and flows into the Atlantic Ocean by the Cotonou channel. Its two important tributaries are the Zou River (150 km) and the Okpara River (200 km). The Ouémé River drains the largest part of Bénin's cotton belt.
- **Oti River** begins in the Atakora hills of Benin at an altitude of about 600 m and flows through Togo and Ghana. In Benin, the Oti River is referred to as the Pendjari River. Tributaries include the Koumongou, Kéran, Kara, Mô, Kpanlé, Wawa, Ménou, and Danyi Rivers. Due to the regulation by the Kompienga Dam in Burkina Faso, the Oti River has a permanent flow with an annual average flow of 100 to 300 m³/s, and can reach more than 500 m³/s.
- **The Niger River** is shared by nine countries in West and Central Africa— Benin, Burkina Faso, Cameroon, Chad, Côte d'Ivoire, Guinea, Mali, Niger, and Nigeria according to the following approximate percentages: Benin (2.5 percent), Burkina Faso (3.9 percent), Cameroon (4.4 percent), Chad (1.0 percent), Côte d'Ivoire (1.2 percent), Guinea (4.6 percent), Mali (30.3 percent), Niger (23.8 percent), and Nigeria (28.3 percent).
- **The Volta River Basin** basin is shared by six riparian countries, of which Burkina Faso (46 percent) and Ghana (39 percent) share the major portion, and the remaining 15 percent are shared by Togo (6 percent), Benin (4 percent), Mali (3 percent), and Cote d'Ivoire (2 percent). The Volta River Basin is the 9th largest in sub-Saharan Africa with an estimated area of 400,000 km².

3.6.6 LAND RESOURCES

The country's terrain is sparse. Five natural regions are distinguished: the coastal region, which is a sandy region bordered by lagoons; the plateau of "La Terre de Barre" composed of clay iron and marshy lands; a silico-clay with a grassy savanna stretching from the north of Abomey to the summits of the Atacora; the mountainous regions of the Atacora with an elevation of up to

800 metres at its highest point, constituting the water reservoir of Benin and Niger; the plains of Niger, which represent a vast fertile and clay land.

The Ramsar Site of the *Complexe W* (895,480 hectares) is a very large wetland complex comprising the W Benin National Park and related protected areas along the national borders with Burkina Faso and Niger, much of which is part of the UNESCO Man and Biosphere Transboundary Biosphere Reserve called "'W' Region". The 'Zone humide de la rivière Pendjari' (144,774 hectares) also a National Park and also a UNESCO Biosphere Reserve, is one of the most important humid ecosystems in the sub-Saharan zone of West Africa, characterized by gallery forests, savannah and swampy meadows, alluvial plains, ponds, rivers, and dense dry forests within floodplains.

3.6.7 WILDLIFE

Among the mammals in Benin are the elephant, lion, panther, monkey, and wild pig, as well as many kinds of antelope. Crocodiles and many species of snakes (including python, puff adder, and mamba) are widely distributed. Partridge, guinea fowl, and wild duck, as well as many kinds of tropical birds, are common. Insects include varieties of tsetse fly and other vectors of epidemic disease.

3.6.8 ENDANGERED, THREATENED, AND PROTECTED SPECIES AND THEIR HABITATS

According to a 2006 report issued by the International Union for Conservation of Nature and Natural Resources (IUCN), the number of threatened species included 6 types of mammals, 2 species of birds, 1 type of reptile, 8 species of fish, and 14 species of plants. Threatened species include the cheetah, the sandbar shark, the green turtle, and the roan antelope. Historically Benin has served as habitat for the endangered painted hunting dog, *Lycaon pictus*; however, this canid is thought to have been locally extirpated.

Factors which contribute to the endangerment of the wildlife in Benin are the same as those which threaten the forests. As of 2002, there were at least 188 species of mammals, 112 species of birds, and over 2,500 species of plants.

3.6.9 PROTECTED AREAS AND NATIONAL PARKS

Benin has fields of lying fallow, mangroves, and remnants of large sacred forests. In the rest of the country, the savanna is covered with thorny scrubs and dotted with huge baobab trees. Some forests line the banks of rivers. In the north and the northwest of Benin the Reserve du W du Niger and Pendjari National Park attract tourists to see elephants, lions, antelopes, hippos, and monkeys. Pendjari National Park together with the bordering Parks Arli and W in Burkina Faso and Niger are among the most important strongholds for the endangered West African lion. With an estimated 356 (range: 246–466) lions, W-Arli-Pendjari parks harbor the largest remaining population of lions in West Africa.

Pendjari Park, where the buffer zone has been reviewed and expanded by UICN, and W Park are actually receiving species who are fleeing human implementation from Arly Park in the area,

3.6.10 ENVIRONMENTAL DATA

3.6.11 ENVIRONMENTAL STUDIES OF AFFECTED AREA

3.7 POLICY, LEGAL, REGULATORY AND PERMITTING REQUIREMENTS

3.7.1 RELEVANT AND APPLICABLE HOST GOVERNMENT POLICY, LEGAL, AND REGULATORY REQUIREMENTS

The institutional framework surrounding pesticide management lies within four main ministries: the Ministry of Agriculture, Livestock and Fisheries (MAEP), the Ministry of Environment, the Ministry Water and Energy and the Ministry of Health.

The Ministry of Environment (Ministère du Cadre de vie et du Développement Durable) is in charge of environmental legislation and regulation across all sectors in Benin.

The Benin Environmental Agency (ABE) is responsible for the enforcement of environmental regulations in the form of monitoring and effective mitigation of the negative impacts of projects including conducting Environmental Impact Assessments. This agency is responsible for managing the National Observatory of the Environment, enforcing some ratified international conventions including national environmental regulations, conducting and documenting activity reports and leading impact assessments on several activities that pose potential environmental risk in country

National expertise and funds are lacking at the national, regional and district levels. This problem involves both technical personnel and other players (research department, NGOs, and so on), in that there is not enough capacity to conduct inspection visits and environmental biomonitoring of the IRS areas. The AIRS and VectorLink IP has taken measures to have ABE and Ministry of Environment personnel accompany IP staff (the ECO) on environmental scoping and inspection visits, before, during and after IRS activities.

The National Centre of Management of Fauna Reserves (Centre National de Gestion des Réserves de Faune, or CENAGREF) is in charge of national park management in Benin. Its mission is to conserve and manage nature reserves, national parks, wildlife reserves, special reserves and their buffer zones. CENAGREF is active in the Pendjari National Park and the W National Park. CENAGREF reports to the Ministry of Environment and Nature Protection.

The Ministry of Agriculture (Ministère de l'Agriculture de l'Elevage et de la Pêche) is in charge of all chemicals and substances that are used in pest control. The national strategy for management of plant protection products is to reduce pests and increase production while protecting human health and ecosystems. They actively engage in three main activities with respect to pesticides: stopping the introduction, distribution and use of banned plant protection products active ingredients; ensuring the sale of approved plant protection products (i.e. pesticides, herbicides and fertilizers) and ensuring that the application of these products is regulated only by authorized companies.

The strategic actions related to the management of pests and pesticides are primarily the competence of the **Direction of Agriculture** (DAGRI) of the Ministry of Agriculture, including the **Plant Protection Service** (SPV). This service is responsible for monitoring the professional amenities and imported and distributed plant protection products. Inspections are carried out by

plant protection inspectors at land borders, port and airport, and by VPD officers from the **Regional Action Centers for Rural Development (CARDER)**.

The **CNAC** (Comité National d'Agrément et de Contrôle des Produits Pharmaceutiques); is the committee under Ministry of agriculture in charge of all pesticide registration and regulation in Benin.

The Ministry of Energy and Water sets general water sector policies and supervises their application. National sanitation policies are defined by the Hygiene and Basic Sanitation Authority (DHAB) under the Ministry of Health.

Apart from the Government of **Benin Environmental Act** (Loi-Cadre sur l'Environnement en Republique du Benin) (no. 98-030 of February 12th 1999) and the Guide General de Realisation d'une Etude d'Impact sur l'Environnement (from February 2001), which gives the format and requirements for the Environmental Impact Assessment required by the Beninese Environmental Agency (ABE), there are other regulations that need to be considered and respected for the implementation of the IRS program. These include:

Law No 91-004 of 11 February 1991 on phytosanitary regulations in the Republic of Benin: the provisions concerning health protection of plants and plant products, for the prevention and fight against pests both including their introduction to their spread in the country, in order to safeguard and ensure a satisfactory environment favorable to sustainable development.

Decree n° 2001-235 of 2017 establishes the organization of Environmental Impact Studies Procedures. This decree provides for the organization of the environmental impact assessment procedure, which may be simplified, for projects of minor importance, or in depth, for those major projects which are intended to be carried out in an area of risk or ecologically sensitive

Decree No 92-258 of September 8th 1992 establishes the application modalities of the law No 91004 on February 11th 1991 on Phytosanitary Regulation. Furthermore, in addition to being responsible for the registration of pesticides in Benin, the Ministry of Agriculture provides for the Plant Protection Service (Service de Protection de Vegetaux) whose role is to ensure surveillance of the pesticide's use, transport, and disposal.

Decree No 2001-235 from 12th of July 2001 This decree touches on the organization of the procedures of the Environmental Impact Assessment for the Government of Benin. This decree outlines the projects in Benin that require a "simple" EIA, and the projects that require an "In Depth" EIA. In the context of PMI IRS in Benin, IRS will not require an "In Depth" EIA, because spraying will not take place within wetlands or biodiversity of international significance, for example: RAMSAR sites.

Law No 98-004-on Labor Code from January 27th 1998 The Beninese Workers conduct and safety law outlines that there must be security and heads of establishment. All personnel will be managed and supervised such that risks are minimized as much as possible and that they follow safety guidelines approved by the WHO, which will be outlined in cascade trainings.

Law No 87-015 of 21 September 1987 on Public Hygiene Code: legislation on housing, noise, water, environmental pollution, industrial facilities, beaches, classified establishments, animal health.

Law No 2010-44 of October 21st 2010 on Water Management in Benin: Governs the management of water and water resources in quantitative and qualitative terms.

Law No 2002-016 of 18 October 2004 on the regime of wildlife in Benin: Lays down the provisions for the rational and participatory management of wildlife and its habitats, creation and management of protected areas in the protection of endangered species, vulnerable or endemic, and finally to the offenses and penalties.

Decree no. 2011 – 394 of 28 May 2011 governs the conservation of nature in Benin, specifically with regards to the buffer zone around protected areas. Title 4, Article 36: the buffer zone is the bandwidth of at least 5 km belt which is intended to buffer a protected area, in this case, the Pendjari National Park and the W National Park.

Law No 93-009 from 02 July 1993 governing forests in Benin: lays down the provisions on "the management, protection, forestry, trade and industry of forestry and related products." The Forest Code defines the different types of forest regime (federal, private, community, assigned), their management and wildlife reserves and hunting issues.

Benin is also a signatory to a number of International Conventions and has ratified various multilateral agreements. Please see table below.

3.7.2 RELEVANT AND APPLICABLE INTERNATIONAL STANDARDS AND BEST PRACTICES

No	Convention / accord	Ratification Date (or signature)
01	United Nations Framework Convention on Climate Change	30 June 1994
02	United Nations Framework Convention on Desertification	30 June 1994
03	Convention on Biological Diversity	30 June 1994
04	Convention on cooperation for the protection and enhancement of the marine environment and coastal areas of West and Central Africa	16 January 1997
05	Kyoto Protocol	25 February 2002
06	Convention on wetlands, habitats of water birds -Ramsar Convention	20 January 2000
07	UNESCO World Heritage Convention	14 September 1982
08	Bonn Convention-Conservation of Migratory Species	1st April 1986
09	Inter-African Phytosanitary Council IAPSC	1st April 1974
10	Stockholm Convention on POPs	23 May 2001
11	Basel Convention	12 April 1997

3.7.3 RELEVANT AND APPLICABLE PERMITTING REQUIREMENTS

The **CNAC** (Comité National d'Agrément et de Contrôle des Produits Pharmaceutiques); is the committee under Ministry of Agriculture in charge of all pesticide registration and regulation in Benin. To be imported, manufactured, and packaged for placing on the national market, plant protection products must be approved, and CNAC is assisting the Ministry of Agriculture in this process. However the Ministry has not yet defined the exact process by decree.

The SPV (Service de Protection des Végétaux)/Ministry of Agriculture: There is still a very large black market for unapproved pesticides in Benin and for reasons of lacking capacity to conduct the monitoring and inspections.

4.0 ALTERNATIVES, INCLUDING THE PROPOSED ACTION AND CONNECTED ACTIONS

4.1 DESCRIPTION OF PROPOSED ACTION

The preferred action is to implement an IRS program in selected communities, choosing among the pyrethroid, carbamate, organophosphate, neonicotinoid classes and the clothianidin/deltamethrin combination, as well as chlorfenapyr when PQ-listed, considering current entomological, epidemiological, logistical, and environmental conditions.

4.2 DISCUSSION OF ALTERNATIVES

4.2.1 ALTERNATIVE 1 (PROPOSED)

The preferred action is to implement an IRS and ITN distribution program in selected communities, choosing among the pyrethroid, carbamate, organophosphate, neonicotinoid classes and the clothianidin/deltamethrin combination, as well as chlorfenapyr when PQ-listed, considering current entomological, epidemiological, logistical, and environmental conditions. PMI has developed a comprehensive set of mitigation measures (EMMP) to avoid negative environmental and health impacts, and has performed IRS in a multitude of countries with minimal impacts. All insecticides are managed in accordance with both host country regulations and US 22 CFR 216.

Storerooms for keeping IRS insecticides and materials are selected based on PMI BMP guidelines on siting and other building requirements. Requirements for insectary location and structure (for example, internal environment control) may result in the unavailability of appropriate existing structures for an insectary. Under the proposed action, when such situations arise, PMI may approve small scale construction or refurbishment for IRS storerooms or insectaries to meet the WHO and PMI BMP and in compliance with the EMMP in Annex A of this document.

4.2.2 ALTERNATIVE 2: ALTERNATIVE IRS GEOGRAPHICAL SITES CONSIDERED

In IRS implementation, areas considered highly malarious and those areas that fit within the NMCP strategic plan were considered, while lower-risk areas were not considered for IRS as an intervention. Using different criteria for selecting geographical sites would reduce the effectiveness and impact of IRS, decreasing progress towards the goals of the Benin NMCP and the PMI program.

4.2.3 ALTERNATIVE 3: USE OF ALTERNATIVE INSECTICIDE(S)

For PMI-supported IRS, a pesticide listed by the WHO PQ, must be selected for use. The PQ is an international institution that analyzes and recommends pesticides to be used in IRS, based on their effectiveness and toxicity to human health and the environment.

To date, the WHO PQ has recommended the use of pesticides within the following six classes of pesticides: pyrethroids, carbamates, organochlorines, organophosphates, neonicotinoids and the clothianidin/deltamethrin combination. The proposed action for Benin includes the potential to use five of these six approved classes and formulations: including chlorfenapyr when recommended

by the WHO PQ, but with the exception of organochlorines (DDT). Use of alternative pesticides is not permitted.

PMI and their IPs will monitor WHO PQ proceedings towards recommendation of new pesticides, but will seek to amend this SEA before there is any decision to use new WHO PQ recommendations, other than chlorfenapyr.

4.2.4 ALTERNATIVE 4: ALTERNATIVE TECHNOLOGIES

A full range of known, available technologies are continually considered for use by the stakeholders in malaria prevention and control efforts. For example, the application of larvicides and environmental control are two other methods that may be considered for malaria control. Larvicides are applied to waterbodies that serve as breeding places for mosquito to eliminate mosquito eggs and larvae before they develop into adult mosquitoes. Environmental management for malaria control is limited to some-common sense safeguards, such as limiting standing water, which can serve as a breeding ground for mosquitoes. PMI does not support environmental management or larviciding as malaria vector control methods. Because of the diverse availability of breeding spots, life-cycle requirements and the adaptability shown by malaria vectors, these practices have not demonstrated large-scale effectiveness.

It has been determined that IRS plays a significant part in malaria prevention, in concert with other technologies.⁹ The specific focus of this PMI project is performance of IRS and distribution of ITNs, and the role that PMI plays in Benin includes IRS. If other, viable approaches were to arise that would replace or improve upon the role that IRS plays, the NMCP, PMI, and its partners would evaluate them and proceed accordingly.

4.2.5 ALTERNATIVE 5 (NO ACTION) NO-PROJECT ALTERNATIVE

IRS and ITN distribution are two of the critical interventions in the control of the spread of malaria. A no-project alternative will result in rising rates of infections, transmissions, mortality, and morbidity, due to the increased prevalence of infected vectors. Therefore, the no-action alternative does not meet the overall goals of Benin's NMCP National Strategic Plan 2017 – 2021, the Global Fund's Technical Strategy, or PMI's Strategy for 2015–2020.

4.3 COMPARISON OF ENVIRONMENTAL IMPACTS

As required by 22CFR216.6(c)(3), the following provides in comparative form, impacts of the proposed intervention, reasonable alternatives, and the no action scenario.

⁹ PRESIDENT'S MALARIA INITIATIVE Malaria Operational Plan (MOP) Benin FY 2019

Table Text Style <i>[Tailor based on SS/EA findings]</i>	Alternative 1 (Proposed)		Alternative 2 (Alternative Geographical Sites)		Alternative 3 (No Action Scenario)	
	Construction	Operation	Construction	Operation	Construction	Operation
Water Resources	0	-1	0	-1	0	0
Water usage for insecticide dilution and cleaning	0	-1	0	-1	0	0
Land Use						
Building storerooms and insectaries	-1	0	-1	0	0	0
Building fixed soak pits	-1	-1	-1	-1	0	0
Socioeconomic						
Social	+1	+2	+1	+1	0	-2
Economic	+1	+2	+1	+2	0	-1
Public Health						
Reduction in mortality and morbidity	0	+2	0	+1	0	-2
Increased knowledge and capacity	+1	+2	+1	+1	0	0
Efficient waste management system	+1	+2	+1	+1	0	0
Air Quality	0	0				
waste management system	0	-1	0	0	0	0
Habitat Alteration	0	0	0	0	0	0
Waste management	+1	+2	0	0	-1	-1
Biodiversity	0	0	0	0	0	0
Waste management	+1	+2	+1	+1	0	0
GHG Emissions						
Transportation of staff, insecticides and spray teams	0	-1	0	-1	0	0
Energy usage for offices and insectaries	-1	-1	-1	-1	0	0
Operating construction machinery	-1	0	-1	0	0	0
Column Totals	+2	+9	+1	+3	-1	-6
Alternative Totals	+11		+4		-7	

Notes: (+2) highly positive effect/beneficial; (+1) positive effect/beneficial; (-2) significant negative effect/highly detrimental; (-1) negative effect/detrimental; (0) remains the same (i.e., no effect or same rate of change versus becoming progressively worse or better).

4.4 EVALUATION OF THE ALTERNATIVES

Based on the above table, Alternative 1, the Proposed Action, has the most highly beneficial effect, with the least amount of overall environmental impact. Although there are some minor potential negative environmental impacts from construction and maintenance of facilities and the use of water resources, the social, economic, and health benefits outweigh these impacts. In addition, the impacts can be eliminated or minimized by following best management practices and utilizing the mitigation strategies in the Safer Use Action Plan and the Environmental Mitigation and Monitoring Plan.

4.5 RATIONALE FOR ELIMINATING ALTERNATIVES NOT INCLUDED FOR FURTHER EVALUATION

Over time, the IRS project has undergone considerable analysis that indicates it is an essential intervention to reduce the morbidity and mortality of malaria, in concert with other interventions such as net distribution, IPTp and ACTs. The available alternatives will not produce the same benefits as the proposed course of action.

4.6 RANKING OF ALTERNATIVES WITH RESPECT TO SIGNIFICANCE OF ENVIRONMENTAL IMPACTS

The proposed alternative is the only one that produces the desired outcomes. Other alternatives are not as efficient, and will not reduce the malaria burden to the same degree. Please reference the numerical rankings in Table 1.

5.0 ENVIRONMENTAL CONSEQUENCES

Per 22CFR216.6(c), this section forms the analytic basis for the comparisons of the identified alternatives.

5.1 ENVIRONMENTAL IMPACTS OF THE PROPOSED ACTION AND ALTERNATIVES

5.1.1 DIRECT EFFECTS AND THEIR SIGNIFICANCE

POSITIVE IMPACTS

The direct positive impacts of the IRS program are the reductions in child and adult malaria morbidity and mortality, which will result in a reduction in human suffering. In addition, economic losses due to absenteeism or inability to work will be reduced. Other positive impacts include reduced incidence of: miscarriage; low birth weight; adverse effects on fetal neurodevelopment as a result of exposure to malaria; and malaria-related childhood and maternal anemia, complications, and organ failure. There is also the benefit of elimination of other household insects, as well as vermin in some cases.

POTENTIAL NEGATIVE IMPACTS

Contamination of Surface Watercourses and Underground Water

During IRS implementation, it is possible to accidentally release insecticides into water bodies during the transportation and storage of pesticides, application of insecticides to walls, and clean-up of IRS equipment and PPE. It is also possible to have a release that will affect surface or groundwater through washing in areas other than the soak pit, or improper disposal of leftover pesticide. A spill into surface water bodies is a key concern in IRS because it could lead to contamination of water routinely used for multiple domestic purposes. Fish and other aquatic organisms that are vital to a healthy ecosystem could also be affected.

Contamination of underground water resources is also possible through improper disposal of leftover pesticide on the ground, especially if there is a high water table. However, the impacts of this risk are likely to be insignificant, primarily because pesticide disposal is strictly controlled and supervised, and the sites for soak pits are carefully chosen according to the criteria in the PMI BMPs. Secondly, most formulations of pyrethroids, organophosphates, clothianidin and carbamates move slowly through soil, and degrade quickly when exposed to sunlight, hydrolysis, or microbial action in the soil. If wash areas and soak pits are properly constructed and employed, liquid pesticide traces will be captured in the charcoal layer of the soak pit or organic matter in soil, and held until degradation by natural processes.

Potential Impacts to Non-Target Organisms from Insecticides

The potential impacts to non-target organisms from insecticide use is summarized in the table below. It is apparent that the most significant potential effects would be on fish and other aquatic organisms, as well as bees. However, these potential impacts are mitigated by the use of PMI BMPs, and the fact that insecticide spraying is confined to indoor surfaces and eaves, which are only sprayed when winds are low. Also, BMPs regarding liquid and solid waste management are strictly followed, which eliminate or reduce any release to the environment.

Table 1: The Degree of Toxicity of WHO Insecticides on Non-target Organisms

IRS Insecticide	Mammal	Bird	Fish	Other Aquatic	Bee	Persistence	Bioaccumulate
Alpha-cypermethrin (P)	High Toxicity	Medium to High Toxicity	High Toxicity				
Bendiocarb (C)	Medium to High Toxicity	High Toxicity	Medium to High Toxicity	Medium to High Toxicity			
Bifenthrin (P)	Medium to High Toxicity	Medium to High Toxicity	High Toxicity	High Toxicity	High Toxicity	Data Not Found	High Toxicity
Cyfluthrin (P)	Medium to High Toxicity	High Toxicity	High Toxicity	High Toxicity	High Toxicity	High Toxicity	Medium to High Toxicity
DDT (OC)	Low to Medium Toxicity	High Toxicity	High Toxicity	High Toxicity	High Toxicity	High Toxicity	High Toxicity
Deltamethrin (P)	Medium to High Toxicity	High Toxicity	High Toxicity	High Toxicity	High Toxicity	Medium to High Toxicity	High Toxicity
Etofenprox (P)	High Toxicity						
Fenitrothion (OP)	High Toxicity	High Toxicity	Medium to High Toxicity	High Toxicity	High Toxicity	High Toxicity	Medium to High Toxicity
Lambda-cyhalothrin (P)	High Toxicity	Medium to High Toxicity	High Toxicity				
Malathion (OP)	Low to Medium Toxicity	Medium to High Toxicity	High Toxicity	High Toxicity	High Toxicity	High Toxicity	High Toxicity
Pirimiphos-methyl (OP)	Medium to High Toxicity	High Toxicity	High Toxicity	High Toxicity	Medium to High Toxicity	High Toxicity	High Toxicity
Propoxur (C)	High Toxicity	Medium to High Toxicity	Medium to High Toxicity				
Chlorfenapyr (PR)	Medium to High Toxicity	High Toxicity	High Toxicity	High Toxicity	High Toxicity	Medium to High Toxicity	Medium to High Toxicity
Clothianidin (N)	Medium to High Toxicity	Low to Medium Toxicity	High Toxicity	Medium to High Toxicity	High Toxicity	High Toxicity	High Toxicity

Source: IVM PEA 2012 and 2017

Key

High Toxicity	High Toxicity
Medium to High Toxicity	Medium to High Toxicity
Medium Toxicity	Medium Toxicity
Low to Medium Toxicity	Low to Medium Toxicity
Low Toxicity	Low Toxicity
Data Not Found	Data Not Found

5.1.2 INDIRECT EFFECTS AND THEIR SIGNIFICANCE

INDIRECT POSITIVE IMPACTS

IRS will build human and institutional capacity by providing broad-based training to a large number of people associated with IRS operations. From this training, there will be an increase in knowledge and understanding of both IRS-specific and general health and environmental risks and impacts, as well as methods of mitigation of those risks. One of the goals of the IRS program

is to build in-country capacity to the point where IRS can be conducted by national or local government, or by the self-organization of communities, without large-scale external assistance or intervention.

By reducing the malaria burden, the IRS program will improve the education level among children of school going age¹⁰, as a result of the reduction in the number of school days missed, and improve the productivity of the workforce as a result of the reduction in missed work days and days of reduced productivity¹¹.

The IRS program will indirectly contribute to the enhancement of the local economy, in that IRS staff and workers will receive payment for their work. At least some of the money that they receive will be spent and injected into the local economy with a magnification effect, improving revenues for various businesses, as well as per capita income for workers.

In addition, the implementation of IRS requires certain local purchases of products and services, such as operations site building materials, rental of building space and vehicles, and hiring of local labor for the construction or renovation of storehouses and soak pits. Again, these revenues are injected into the economy with potentially positive and significant magnification effects.

The Benin PMI VectorLink project views gender equality and female empowerment as development goals in their own right, as well as approaches that accelerate vector control. VectorLink Benin will mainstream gender across its operations, in line with the project's gender strategy, with an emphasis on women's economic empowerment through employment in its IRS and entomology operations. To achieve this goal, the project will implement policies that promote the hiring of female seasonal workers and ensure a safe and respectful workplace for all.

Finally, a reduction in household pests from IRS may result in a reduction in other diseases carried by the pests.

INDIRECT ADVERSE EFFECTS

Upon termination of the IRS program, PMI will properly dispose of the IRS equipment and will no longer supervise its use. IRS equipment that may be donated to district health officials includes backpack compression sprayers, used or clean boots, PPE, wash basins, progressive rinse barrels, etc. that are still in operable condition. Improper use of this equipment could lead to contamination of the environment or adverse health effects as noted.

In general, if PMI supports the procurement of insecticide or disposition of unused insecticide to the Government of Benin, this activity is required to be mentioned in the annual Letter Report, in addition to this SEA. This type of support requires annual environmental compliance monitoring by PMI and/or the IP, requires that PMI and/or the PMI IP provide environmental training to the Government of Benin in the PMI IRS BMPs, and technical assistance for insecticide selection to ensure quality/appropriateness of the product. If PMI supports the procurement, loan, or disposition of spray pumps or personal protective equipment to the Government of Benin, these activities must be mentioned in the annual Letter Report, in addition to this SEA. These activities do not require environmental compliance monitoring, however, PMI and/or the PMI IP must provide training in the PMI IRS BMPs.

¹⁰ <https://www.worldbank.org/content/dam/Worldbank/Feature%20Story/Africa/afr-marie-anne-valfort.pdf>

¹¹ <https://www.path.org/media-center/fighting-malaria-in-the-workplace/>, Accessed 7/15/19

The conduct of IRS by District Medical Officers with communities, using properly working equipment left behind by PMI may temporarily, and in a minor way increase the total pesticide load on the environment. However, since the IRS equipment will be in operable condition and capacity has been built among the District Medical Officers, it is expected that spray operations will be according to BMPs, and the total pesticide load on the environment is expected to be less than if the donation is not made.

5.1.3 CUMULATIVE EFFECTS AND THEIR SIGNIFICANCE

A cumulative environmental effect of IRS is the potential for contribution to the development of resistance to insecticides by the vector mosquitoes. Although other activities such as agricultural pesticide use have a potentially greater impact, this is a serious problem for IRS and other mechanisms of malaria control, such as ITNs. Widespread resistance to pyrethroids is an established fact in Africa, and has practically eliminated the usefulness of pyrethroids in IRS.

Benin has responded to this threat through the development of an Insecticide Resistance Management Plan, which, among other things, calls for rotation of insecticides on a biannual basis, and incorporation of new insecticides into the rotational scheme upon their PQ-listing by WHO.

Organophosphates are the pesticides with the highest potential for cumulative health impacts. Pyrethroids, carbamates, clothianidin and most organophosphate formulations break down readily in the environment, limiting the risk of cumulative environmental impact, especially if disposal sites are well chosen and BMPs are followed.

However, repeated human exposures to organophosphates result in cumulative cholinesterase depression, with increasingly severe effects. For this reason it is exceptionally important that PPE be worn properly and at all times when pesticide contact is possible. It is also incumbent upon team leaders to monitor the health of their spray operators on a daily basis, and to look for any signs of cholinesterase depression. Formulations of the organophosphate pirimiphos-methyl have been used for several years and in several countries without any report of observed symptoms of cholinesterase depression.

There are indications that the capsule suspension form of Actellic is more resistant to environmental degradation than either Actellic Emulsifiable Concentrate or the other WHO PQ-recommended pesticides. This may result in a temporary build-up of concentration within the soak pit prior to degradation.¹²

5.1.4 AREA OF LAND DISTURBANCE

In the execution of IRS, there are very small areas of land disturbance, and these occur in already developed areas, mainly within health center grounds. An operations site normally consists of a secure storeroom in which to store insecticides, a wash area and soak pit to conduct end of day cleanup and uniform laundering, and sanitary facilities. Upgrade and

¹² Mitchell, David, et al, (2015).

maintenance of these facilities provide a positive benefit to the community, both during IRS and in the off-season, where they can be used for similar or other purposes.

5.1.5 IMPACTS TO ENDANGERED, THREATENED OR PROTECTED SPECIES AND THEIR HABITATS

It is USAID policy to conduct its assistance programs in a manner that is sensitive to the protection of endangered or threatened species and their critical habitats. The Initial Environmental Examination for each project, program or activity having an effect on the environment shall specifically determine whether the project, program or activity will have an effect on an endangered or threatened species, or critical habitat. If the proposed project, program or activity will have the effect of jeopardizing an endangered or threatened species or of adversely modifying its critical habitat, the Threshold Decision shall be a Positive Determination and an Environmental Assessment or Environmental Impact Statement completed as appropriate, which shall discuss alternatives or modifications to avoid or mitigate such impact on the species or its habitat. This document, along with its Annex A, Environmental Mitigation and Monitoring Plan, fulfills those requirements.

IRS is not likely to adversely impact threatened or endangered species, or their critical habitat, due to the fact that spraying activities are conducted indoors only, and are carefully structured to avoid fugitive spray to the outdoors. Any openings to the outside of the house are closed up or avoided during spray. Structures with gaps between wall coverings are ineligible for IRS. Finally, storage and disposal facilities are sited at least 100 meters from any sensitive areas such as habitat for endangered or protected species. Although IRS team may pass through these areas to reach targeted areas for spraying, mitigation measures include putting insecticides in hermetically sealed barrels.

SPECIAL NOTE: IMPACT ON BEES

Spraying in areas near beehives can lead to the death of the bees, which are vulnerable to all WHO-recommended pesticides. In addition, spraying near hives can lead to contamination of edible honey. These risks must be mitigated at all times. In Benin, honey producers are mostly found in the Northwest regions. Modern methods of beekeeping are currently under development throughout Benin, as evidenced by the creation of many beekeeping centers offering various services (training in modern apicultural techniques, production and sale of honey, supervision of groups and/or apicultural associations, etc.) The project will identify locations where beehives are kept, and observe a 30- meter no-spray buffer zone around them. Bee-hive owners will be advised accordingly.

5.1.6 IMPACTS TO FORESTRY AND BIODIVERSITY

No significant impacts to forestry and biodiversity are expected due to the limitations placed upon the choice of locations for operations sites, the use of PMI BMPs in all phases of the project, and the indoor use of insecticides. Waste management and disposal are highly regulated and supervised according to PMI waste management policies, which favor reduction, reuse, and recycling.

5.1.7 WETLAND IMPACTS

No significant impacts to wetlands are expected due to the limitations placed upon the choice of locations for operations sites, the use of PMI BMPs in all phases of the project, and the indoor use of insecticides. Waste management and disposal are highly regulated and supervised according to PMI waste management policies, which favor reduction, reuse, and recycling.

5.1.8 POSSIBLE CONFLICTS BETWEEN PROPOSED ACTION AND LAND USE PLANS

The practice of IRS has very little impact on land use. Facilities that are used year round are limited to 2-3 medium-sized (1500-10,000 sq. ft.) storage buildings, and are usually pre-existing facilities in major urban areas. Most operations sites for PMI IRS are located within land that is already dedicated to health facilities, and developing them for IRS use involves little modification. IRS insecticides and commodities are stored in districts on a temporary basis (~60 days) in pre-existing buildings that are used for other purposes the rest of the year. Occasionally, the project will renovate or expand damaged, insecure, or otherwise unsuitable buildings to meet PMI BMPs, but these facilities are usually put to beneficial use when not occupied by the IRS project.

5.1.9 POSSIBLE CONFLICTS BETWEEN PROPOSED ACTION AND POLICIES AND CONTROLS FOR AREAS CONCERNED

No conflicts are expected due to the limitations placed upon the choice of locations for operations sites, the use of PMI BMPs in all phases of the project, and the indoor use of insecticides. During this environmental assessments, the project has identified all protected areas in the vicinity of operations, and will restrict activities to be in compliance with relevant policies and controls. The project has also researched and documented applicable laws and regulations, and will conform activities to be in compliance.

5.1.10 ENERGY REQUIREMENTS AND CONSERVATION POTENTIAL OF VARIOUS ALTERNATIVES AND MITIGATION MEASURES

IRS has been determined to be an essential component of PMI's goal to reduce the prevalence, morbidity, and mortality of malaria in targeted areas. Given that determination, PMI works with ministries of health in host countries to execute the project in a manner with the greatest possible impact. Therefore, at the present time, there are no feasible alternatives to IRS.

However, there are inherently low energy requirements for the execution of IRS. The fixed requirements consist of electricity for lights, air conditioning, computers, and other office equipment in the occupied facilities. A more significant energy requirement results from the transportation of people, insecticides and commodities to the remote locations where IRS is performed. For economic and logistical reasons, transportation requirements are carefully planned to minimize the type and number of vehicles used, and trips taken, which therefore minimizes the energy (fuel) requirements. Motorcycles are used extensively for supervisor transport, and modified three-wheeled vehicles transport spray operators as well as insecticides and equipment. VL Benin will use trucks for spray operator's transportation during 2020 spray campaign in both districts.

5.1.11 NATURAL OR DEPLETABLE RESOURCE REQUIREMENTS

The major depletable resource usage is the insecticide itself, which is an international import. In Benin, natural materials (branches, shrubs, grass) are used in the preparation of changing rooms and bathrooms. These are renewable resources, and are used in small quantities that do not have a significant impact on the area where they are harvested. The project also uses stone, concrete, wood chips, and charcoal in small quantities for the construction of soak pits for liquid waste disposal.

5.1.12 CONSERVATION POTENTIAL OF VARIOUS REQUIREMENTS AND MITIGATION MEASURES

Although the resource requirements of the project are small, PMI strives to be as efficient and economical as possible. Through the establishment of BMPs and the extensive training of spray team members, all materials are used as efficiently as possible. Insecticide purchase quantities are carefully calculated using population data and knowledge of typical structure sizes in particular areas. Extensive inventory control measures are in place, with serialization of insecticide packages, and complete chain of custody paperwork. Data systems are in place to compare actual vs. projected usage, and anomalies are investigated immediately. Any insecticide leftover at the end of the day is collected, stored, and reused the following day for make-up water. Most IRS insecticides have a two year shelf life, and any insecticide left over from spray operations in a given year are used up the following year before new material is introduced.

Soak pits are used for three years before the materials are evacuated and the wood chips and charcoal are replaced, while the stones are replaced and reused. All commodities are reused from year to year, as practical, and are recycled at end of life, particularly plastic bottles, buckets and basins. Throughout the life of the AIRS and VectorLink projects, over 4,000,000 plastic insecticide bottles have been recycled to produce useful products, such as electrical conduit, paving stones, and oil tanks. Cardboard containers formerly containing insecticide are also recycled wherever the facilities are available in the host country.

5.1.13 URBAN QUALITY

PMI does not perform IRS in urban areas in Benin, so the potential for impact on environmental and social quality are minimal. The project has an office and a central storeroom in Natitingou with a minor effect on traffic.

5.1.14 HISTORIC AND CULTURAL RESOURCES

Through this environmental assessment, historic and cultural resources in Benin have been identified, and measures will be taken to avoid negative impacts. The project will decline to conduct activities in the vicinity of these resources if any impacts are suspected.

5.1.15 DESIGN OF THE BUILT ENVIRONMENT, INCLUDING REUSE AND CONSERVATION POTENTIAL OF VARIOUS ALTERNATIVES AND MITIGATION MEASURES

Please see descriptions above. The built environment for IRS is minimal, operations are designed to be efficient, and recycling is an established practice wherever suitable facilities are available.

5.1.16 MEANS TO MITIGATE ADVERSE ENVIRONMENTAL IMPACTS

PMI has developed a project-wide Environmental Mitigation and Monitoring Plan that considers all potential impacts of the IRS project and lays out the mitigation measures and monitoring plan for those impacts. The EMMP is included in Annex A of this SEA.

5.2 COMPARISON OF ENVIRONMENTAL EFFECTS OF THE ALTERNATIVES

5.2.1 SUMMARY

Accepting that IRS is a necessary component of PMI's strategy to reduce the morbidity and mortality of malaria, the proposed alternative is the one with the maximum positive benefit and the least negative impact. PMI will consistently monitor the alternatives to IRS, and adjust the project and priorities accordingly.

5.2.2 COMPARISON OF REMEDIES AVAILABLE FOR THE ENVIRONMENTAL CONSEQUENCES OF ALTERNATIVES

The remedies to the environmental consequences of the alternatives to the proposed are the same, with the exception of the No Project alternative, which does not meet PMI's objectives, and does not require any environmental mitigation.

5.2.3 OVERALL COMPARISON OF ALTERNATIVES WITH RESPECT TO FEASIBILITY, ABILITY TO MEET PROJECT GOALS, ENVIRONMENTAL IMPACT RANKING, COSTS, AND SCHEDULE FOR COMPLETION

The proposed alternative is the most desirable in terms of the ability to meet project goals, and is more feasible in terms of the needed partnership of the Government of Benin. Its environmental impact is virtually the same as other alternatives, with the exception of the No Project alternative, which does not meet the project's objectives.

5.3 ADVERSE IMPACTS THAT CANNOT BE AVOIDED

The major adverse impact that cannot be avoided is the increase in the load of insecticide on the environment, although that load is largely confined to the inside of homes. There, it is a potential health, rather than environmental impact, through potential resident contact with treated surfaces. The insecticide is designed to dry on the wall in relatively small concentrations, and to be fairly inaccessible in quantities large enough to be harmful. Through the development of BMPs, the intensive training of spray team members, and multiple layers of supervision, the insecticide should be applied where it is needed, and not pose a threat to the health of the beneficiaries.

5.4 RELATIONSHIP BETWEEN SHORT TERM USES OF THE ENVIRONMENT AND MAINTENANCE AND ENHANCEMENT OF LONG TERM PRODUCTIVITY

The use of the environment for IRS is very limited, and will not affect the long term productivity of natural resources.

5.5 IRREVERSIBLE AND IRRETRIEVABLE COMMITMENT OF RESOURCES

IRS is resource intensive, and especially consumes large quantities of insecticide. In addition, there is a large quantity of commodities and consumables required to support the operations. VectorLink strives for resource efficiency, and through experience has developed systems that minimize resource usage. However, the project continually looks for more efficient methods, and is particularly good at disseminating best practices seen in one country across the entire portfolio, as practicable.

6.0 ENVIRONMENTAL MITIGATION AND MONITORING PLANS

6.1 ENVIRONMENTAL MITIGATION PLAN

This section outlines the mitigation plan proposed for the potential adverse impacts outlined in Section 5. The primary mitigation measures include delivery of a mix of information, education, and communication (IEC) approaches targeting the residents and spray operators and all IRS personnel, training of spray operators and strengthening supervision and monitoring, and provision of appropriate PPE and facilities for the storage and disposal of pesticides and contaminated waste. The mitigation measures, along with monitoring and reporting information, are compiled in the EMMP found in Annex A.

6.1.1 IMPLEMENTATION CONDITIONS

This section details the elements of the Safer Use Action Plan for the implementation of the proposed IRS project in Benin. During implementation, PMI/Benin and its PMI IRS IPs will adhere to the conditions detailed in this Safer Use Action Plan, and in the EMMP of this report.

QUANTIFICATION OF PESTICIDE REQUIREMENTS

The PMI IRS IP will conduct an annual logistics assessment for all targeted districts for planning and procurement of the correct quantity of materials, including insecticides. Purchase of insufficient pesticide will lead to shortages, delays, and possibly the inability to spray all targeted areas. Purchase of too much pesticide may lead to expiration of the pesticide before it can be used up, which creates serious storage and disposal problems.

PESTICIDE QUALITY ASSURANCE

The procurement and use of pesticides that do not meet the necessary quality assurance standards can compromise the overall spray quality and desired vector action, and at the same time expose the residents and spray operators to hazards related to altered toxicological characteristics.

The PMI program will procure the insecticide from a reputable supplier. Pesticide batches will be analyzed for the concentration of the active ingredient prior to shipment to Benin. Additional sampling and testing may be performed upon arrival. Delivery of all insecticide to the central

warehouse will be supervised by PMI before the insecticide is dispatched to the districts where spray operations will be concentrated.

PESTICIDE TRANSPORT

After the receipt of insecticide at the central warehouse, insecticides are transported to the district warehouses by road, and in some areas, over water in boats. During transportation, there is a risk of vehicle accidents and consequent insecticide spillage. It is essential that the vehicle type and speed of transport be matched to the conditions; drivers must take no chances.

A lockable box truck is the expected vehicle to transport insecticides over land from central to district stores. If box trucks are not available, Chief of Party or ECO will notify the VectorLink Technical Project Manager and the Director of Environmental Compliance to receive instructions for an alternative security mechanism. All vehicles must be in good condition and pass the Pre-Contract Vehicle Inspection performed by the Environmental Compliance Officer (ECO) or a qualified designate, using a smart phone.

Prior to long-distance transport of the insecticide from the customs warehouse or VectorLink Benin central storage facility, drivers will be trained on general issues surrounding the insecticide and how to handle emergency situations such as accidents or spillage. Training for long-distance transport will include the following information:

- Purpose of the insecticide (indoor use for malaria protection, not for agricultural or any other outdoor use)
- Toxicity of the insecticide
- Security issues, including implications of unauthorized access to or use of the insecticide
- Hazardous places along the routes to be taken, and mitigation measures
- Steps to take in case of an accident, spill, or emergency (according to BMP standards)
- Combustibility, and toxicity of the combustion byproducts of insecticide

Drivers hired for intra-district transport of insecticide and spray team members during the spray campaign will receive training in:

- Operator transportation best practices and vehicle requirements from PMI IRS BMP #2, Worker and Resident Health and Safety
- Health and safety as provided to spray operators, with the exception of sprayer operation and spray practice
- Handling an accident, spill, or emergency according to BMP standards
- Handling vehicle contamination
- Vehicle decontamination procedures

Figure 1 provides a list of eight key responses to mitigate the impact of an insecticide spill.

Figure 1: Emergency Response to a Spill

IN CASE OF INSECTICIDE SPILLS

1. Control, contain, and clean up the spill.
2. Don protective clothing prior to attempting to clean the spills.
3. It is imperative to avoid fire as a result of the accident, and a fire extinguisher should be deployed just in case. The engine must be shut off and smoking in the area strictly prohibited.
4. Onlookers and bystanders must be kept away from the accident site.
5. If the crew has come in contact with the pesticides, they must remove contaminated clothing immediately and wash the pesticide off their skin.
6. For major spills send for help immediately; Drivers must have a charged cell phone and an emergency number for use in such cases.
7. People must be kept away and the spill covered with earth, sand, etc., no attempt should be made to wash away the spill with water or other substances.
8. Vehicles that are used for transporting large quantities of pesticides are required to be equipped with a bucket of sand, sawdust or soil, a shovel, and fire extinguisher.

Because vehicles used for insecticide transportation can be used for the transport of other goods, it is important to ensure that vehicles are decontaminated after use. The drivers will be responsible for cleaning and decontaminating the interior of the vehicle and exterior bed, at the end of the spray campaign. Drivers will be provided with gloves, overalls, and rubber boots to wear for cleaning the vehicle. All cloths used in wiping down the interior and bed of the vehicle will be washed with soap and water.

If pesticide is transported over water, BMP #10, Water Transport (PMI IRS BMP Manual, 2015) must be followed in every detail.

QUALIFICATION OF WAREHOUSES (STORAGE FACILITIES)

IRS pesticides can cause adverse impacts to human health, animals, and the natural environment if not properly stored according to PMI BMPs. Before insecticides are procured or transported to the spray areas, suitable warehouse(s) must be assessed to ensure that they can meet BMP standards. During the geographical reconnaissance and logistics assessments, the need for new district warehouses or rehabilitation of previously used district warehouses to meet PMI IRS BMP standards for pesticide storage will be assessed. The standards include:

- Located at least 30 meters from flood plains, wetlands and water bodies, markets, schools, dwellings, beehives, and protected areas. Warehouses may not be located in the buffer zones of protected areas, or in schools while in session.
- Spacious enough to store insecticides in bulk and to store other IRS commodities separately
- Providing a separate space for the storekeeper's office
- Well ventilated and allowing for air circulation
- Built of concrete or other solid material
- Impervious flooring, or floor must be completely covered by a leak-free tarpaulin
- Watertight roofing
- Barred and screened windows
- Preferably two exits from the pesticide storage area for emergency purposes
- A fire extinguisher

In addition to the above, all facilities used for storage, distribution, and transportation of insecticide products should comply with relevant requirements of Benin pesticide regulations. During the logistical needs assessment, the PMI IRS IP will identify warehouses at the district level that can meet these requirements. PMI cannot provide funds for the construction of new buildings, but can assist in the modification or renovation of existing facilities. In Benin, IRS is implemented in partnership with the Ministry of Health/NMCP; therefore, some warehouses are located on Health center property for logistic and security purposes. This would meet the eligibility criteria of the project requirements.

QUALIFICATION OF LIQUID WASTE DISPOSAL FACILITIES (WASH AREAS, SOAK PITS, AND EVAPORATION TANKS)

Pyrethroids, organophosphates, neonicotinoids, and carbamates degrade quickly when exposed to environmental action such as photolysis, hydrolysis, and bacterial action. If wash areas and soak pits are properly constructed in appropriate locations and used according to BMPs, liquid pesticide waste will be captured in the charcoal layer of the soak pit and held until it breaks down by these natural processes.

Site considerations for locating IRS cleaning and waste facilities (progressive rinse, wash areas, soak pits, and tanks) include soil type, topography, vertical distance to ground water, and proximity to schools, lakes, streams, and other sensitive areas. Ideally, disposal facilities should be located adjacent to the storage facilities, where they can be more easily protected and monitored. However, the setting or the function of buildings provided for storage are not always appropriate for siting a wash area, so it may need to be placed some distance away. Due to access limitations and distance to some spray sites, it may be more feasible to locate a small wash facility in an appropriate area near the spray site.

Soak pits must be located at least 30 meters from any sensitive areas such as water bodies, flood plains, habitat, schools and other public buildings, areas protected by regulations, mining extraction sites, and areas of high groundwater. They should be located on relatively high ground to increase the vertical distance to groundwater. The general area should be level, but the wash area must be constructed to slope gently toward the soak pit or toward the collection point that is piped to the soak pit/evaporation tank.

Although the soak pit captures the majority of pesticide from wash waters, small amounts may pass through and enter the soil below. Soil characteristics affect how pesticides move through

the soil, and how they break down by environmental or microbiological degradation. Clay soils have a high capacity to absorb many pesticides, but if hard-packed may have limited percolation abilities. Sandy soils have a much lower capacity to absorb pesticides, but liquids percolate rapidly. Where possible, locate facilities on fine textured soils with organic content and good absorptive properties to capture and degrade trace amounts of pesticide. Hard-packed clay or rocky soils are not appropriate.

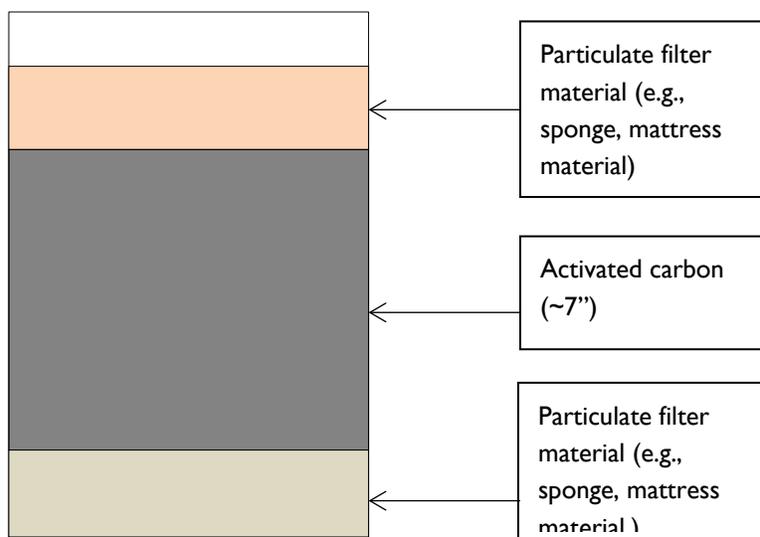
Pesticides may move in water runoff as compounds dissolve in water or attach to soil particles. Facilities should be located on high, level ground to minimize exposure to runoff. Avoid steep slopes or natural runoff flow lines. Where necessary, curbs or berms will be constructed around wash areas to divert storm water runoff away from the soak pit, and to contain any spills or overflows. In very rainy areas or seasons, it may be necessary to cover the soak pit and wash area with a tarpaulin when not in use, to prevent flooding of the soak pit and subsequent runoff of pesticide-contaminated water.

Mobile Soak Pit (MSP)

To reach certain targeted spray areas, operators must travel a great distance, and they may not be able to return at the end of the day to a centralized wash area for clean-up.

Sometimes the operators will spend several days in the field, finding lodging and food in the villages where they finish their work for the day. The next day, they either continue to work at the same village, or travel on to the next targeted spray area. Working this way can reduce transportation requirements, shorten the working day, and result in greater productivity. However, operators need a different system for clean-up at the end of the day.

Figure 2: Mobile Soak Pit Layers



Designed and drawn by Peter Chandonait, Abt Associates, Inc.

In this situation, the operators carry a MSP filter, wash barrels, and a tarpaulin with them, and construct a temporary wash facility at a suitable site within the village where they will stay. The MSP filter is a 20-25 L bucket with highly adsorbent activated carbon that removes pesticide contamination from the wash water, so that the water that exits to the ground is purified. For more information on the mobile soak pit, please see the PMI BMP manual.¹³

and construct a temporary wash facility at a suitable site within the village where they will stay. The MSP filter is a 20-25 L bucket with highly adsorbent activated carbon that removes pesticide contamination from the wash water, so that the water that exits to the ground is purified. For more information on the mobile soak pit, please see the PMI BMP manual.¹³

¹³ Chandonait, Peter. February 2015. *President's Malaria Initiative BMP Manual Best Management Practices (BMP) For Indoor Residual Spraying (IRS) In Vector Control Interventions*. Bethesda, MD. PMI | VectorLink Project, Abt Associates.

WAREHOUSE & STORAGE RISK MANAGEMENT

In order to mitigate risks associated with pesticide storage, the following will serve as warehouse/storage best management practices:

- A trained storekeeper will manage each facility and will wear gloves, a mask, overalls, and boots when in the pesticide area of storage.
- No smoking or eating will be allowed within 30 meters of the pesticide storeroom.
- Pesticide storage facilities must have thermometers installed for daily temperature recording.
- Basins, soap and clean water will be available at all times in all the facilities.
- Recommended pesticide stacking position and height in the warehouse as provided in the FAO Storage and Stock Control Manual will be followed.
- A fire extinguisher will be available in the storage facilities and all site workers will be trained on how to use this device.
- Warning notices will be placed outside of the store with a skull and crossbones pictogram and warnings in the local language.
- Insecticides must be lifted off of the floor via pallets or shelves, and separated from the walls of the storeroom by 9-12 inches.
- First aid kits must be fully stocked and available in all the central warehouses and secondary stores. Security and inventory management of first aid supplies is mandatory.

Accidental Warehouse Fires

Inhalation of toxic fumes in the event of a storehouse fire is a major risk of IRS. The risk can be minimized, however, by following BMPs for storage, including prohibiting lighted materials in or near the warehouse or in the vicinity of pesticides during transport to/from vehicles, providing fire extinguishers, and proper ventilation of storerooms.

FETAL EXPOSURE (PREGNANCY TESTING)

All female candidates for spray teams will be tested for pregnancy before being recruited into the spray operations, and every 30 days until operations end. Provided their work history has been acceptable, females who have been hired and later found to be pregnant will be reassigned to positions that do not have the potential for exposure to insecticides. Women who are breastfeeding cannot have any contact with pesticides, and are thus prohibited from spraying of pesticide or washing contaminated items.

SPRAY OPERATOR EXPOSURE

The individuals recruited for IRS campaigns will receive intensive training on the use, operation, calibration and repair of the spray pumps, including hands-on exercises prior to the beginning of the spraying campaign. They will also be trained to understand proper hygiene, to recognize the signs and symptoms of poisoning, and to understand the referral procedure for any incidents involving poisoning. This training will be conducted in accordance with the IRS Training Guide for Spray Operations (USAID, 2009) and the 2015 IRS BMP manual. Potential spray operators must also pass written and practical tests at the end of training.

Training for monitoring spray operators for symptoms of pesticide exposure will be mandatory for team leaders and supervisors, as well as for storekeepers and other senior personnel. Any case of an operator or beneficiary displaying symptoms of exposure will require the immediate completion of a standard Incident Report Form by the district coordinator, who will forward the

report to the IP's headquarters within 24 hours. The incident report must be received from the IP's Technical Project Manager by PMI COR within 48 hours.

For malathion and fenitrothion organophosphates, it may be necessary to monitor the level of acetyl cholinesterase in any worker who may have been exposed to contamination. Occupational exposures to organophosphate insecticides are measurable using blood cholinesterase testing and urinary excretion of chemical biomarkers. PMI has evaluated various approaches for monitoring sprayer exposure to organophosphates, and has determined that biomonitoring is not required when using pirimiphos-methyl. Moreover, the WHO PQ Working Group recommendations stated that "provided that operational guidelines are followed, routine cholinesterase monitoring of spray men during IRS programs is not required" for Actellic 300 CS.

BENEFICIARY EXPOSURE

Residential exposure will also be monitored. During the IEC campaign, residents are made aware of the steps to take if exposed, and, especially if acute symptoms are encountered, the advice is to report to the nearest health facility. Thus, reported cases at health facilities or by IEC mobilizers will serve as the principal monitoring strategy for beneficiary exposure incidents.

NMCP, DMOs, and the PMI IRS IP and other partners will work with relevant institutions at all levels to carry out an IEC/BCC campaign to sensitize residents to IRS activities, in accordance with WHO guidelines and also the Benin National Malaria Strategic Plan 2017 – 2021 and PMI Malaria Operational Plans. The IEC campaign (as well as IRS project leaders and Ministry of Health/NMCP Officers) should focus on the following elements of residential safety during an IRS program:

- Clear homes of mats or rugs, furniture, cooking implements and foodstuffs prior to spraying; If furniture cannot be moved out of the home, then move it to the center of the room and cover with impermeable material.
- Residents must stay at least 10 meters from the home during spraying, and for two hours after spraying.
- Move and keep all animals at least 10 meters from the home during spraying, and for two hours after spraying.
- After two hours, open all windows and doors and air the house out for ½ hour.
- Sweep up any insects killed from the spraying and drop them in latrine pits before allowing re-entry by children and animals.
- Do not relater or paint over the sprayed walls after spraying.
- Keep using bed nets for additional protection against malaria.
- If skin itches after re-entrance into home, wash with soap and water; For eye irritation, flush eyes with water. For respiratory irritation, leave the home for fresh air; For ingestion, or if symptoms of other types of exposure persist, contact program staff or go to nearest health facility that has the appropriate medical intervention.

If spraying during the rainy season, the teams should adhere to the following Contingency Plan, which will minimize exposure of household effects.

- Each spray operator must be given adequate covering material (3m by 3m minimum), which should then be used to cover household effects that have been moved to the center of the room (rather than outdoors) because it has started to rain. More than one sheet may be required, depending on the size of structures and the amount of belongings.

- Household effects can also be moved into structures that are not targeted to be sprayed, e.g., an isolated kitchen or domestic animal shelter.
- Household effects can alternatively be moved to one room that will not be sprayed on that particular day, but on the next day.
- The spray teams should pay close attention to any signs of potential rains so that they prepare the communities accordingly.
- When it rains in the middle of spraying, stop the spraying activities; resume when the rain stops and the skies clear.

PESTICIDE EXPOSURE AND TREATMENT

All spray operators, team leaders, and supervisors will receive detailed training on the emergency steps to take if accidental exposure to the chemical occurs, including ingestion, inhalation, or eye or dermal contact with the chemical. This training will be conducted by the district and sector coordinators, and will include drills to test knowledge of the operators. However, most interventions for acute exposure will have to be provided by medical professionals at the nearest health clinic, so transporting the exposed person to the health clinic will be the priority.

PMI IP will confirm that all the health facilities around the spray sites have in their store the recommended treatment drugs, and that all the staff responsible for administering emergency treatment for pesticide exposure receive appropriate training. Annex E provides additional information on symptoms and treatment protocols.

SOLID AND LIQUID CONTAMINATED WASTE MANAGEMENT

Non-contaminated wastes, or those that can be cleaned thoroughly with soap and water, will be recycled whenever possible, or disposed of in a municipal landfill if there is no appropriate recycling outlet.

Liquid contaminated wastes will be disposed of on a daily basis in soak pits that are carefully sited and designed according to the criteria in this Safer Use Action Plan and the PMI BMP manual. The soak pit is designed so that pesticides are adsorbed by the charcoal layer and held until environmental processes result in the degradation of the pesticide. Thus, there should be no contaminated liquid waste to deal with at the end of the spray season.

Contaminated solid wastes are incinerated in incinerators that are capable of destroying the pesticide and preventing environmental contamination.

Incinerators recommended for disposal of contaminated wastes fall into two categories:

- Basel Convention technical standards, for all insecticides that do not contain greater than 1% chlorine
- WHO/FAO standards, which apply if using DDT or insecticides that contain >1% chlorine

For wastes containing less than 1% chlorine:

- The recommended combustion temperature is >850 °C.
- An after-burner is required, with a residence time of at least two seconds.
- The incinerator must have emission control, including particulate matter filters.
- Ash and slag produced by high-temperature incineration of pesticides are best incorporated into concrete and buried in a secure location. In Benin, as such solid wastes are incinerated in a private incinerator, ash and slag will be incorporated into cement blocks and buried.

For wastes containing greater than 1% chlorine:

- The recommended combustion temperature is between 1100 and 1300 °C.
- An after-burner is required, with a residence time of at least two seconds.
- A quench rinse that causes a rapid temperature drop to below 250 °C is needed for the gas stream.
- The incinerator must have emission control, including particulate matter filters.
- Ash and slag produced by high-temperature incineration of pesticides are best incorporated into concrete and buried in a secure location. In Benin, as such solid wastes are not incinerated in a PMI-owned incinerator and the IP does not have control over the ash and slag, VectorLink can only recommend this disposition.

Incineration is not recommended for polyvinyl chloride or other chlorinated wastes such as gloves and boots. Gloves and boots no longer usable for IRS can be easily decontaminated with soap and water and then offered to spray team members, or disposed of as normal non-hazardous waste.

Empty plastic containers should not be incinerated, due to the difficulty inherent in burning them cleanly and the nuisance and toxic emissions that may result. Once punctured to prevent reuse, plastic bottles can be triple-rinsed and recycled at an appropriate facility, or landfilled.

Cardboard boxes previously containing intact insecticide sachets or bottles are not considered contaminated waste. In many cases uncontaminated boxes can be recycled, or can also be disposed of as normal non-hazardous wastes. Incineration is not recommended for cardboard boxes unless they have been contaminated by pesticide leakage or used for the storage of other contaminated wastes. In Benin, the incineration of contaminated wastes from IRS activities will be handled at Ordre de Malte Hospital. For recycling of plastics and uncontaminated cardboard boxes, CISE Recycling Plant (for recycling plastic) and GHES Company (for recycling cardboard boxes) are the main agreed companies that have been working with the IRS project in past years and will continue handling this task.

The EMMP provides details on the steps and measures that will be taken to prevent negative impacts on the non-target ecosystems from liquid and solid IRS waste materials and disposal practices.

6.2 ENVIRONMENTAL MONITORING PLAN

Please see the project-wide Environmental Mitigation and Monitoring Plan in Annex A.

7.0 LIST OF PREPARERS

[List the names and qualifications (expertise, experience, professional discipline) of the persons primarily responsible for preparing the Environmental Assessment or significant background papers.]

8.0 APPENDICES

8.1 TERMS OF REFERENCE

[Terms of Reference (TOR) of the EA include: a) Requirements related to data on ecological resources within the defined geographic zone; b) Timeframes for all phases of the project; c) Information gaps/survey needs that should be addressed in order to assess potential impacts and their significance.]

8.2 RELEVANT MAPS

BÉNIN



Figure 3: Benin administrative departments¹⁴

¹⁴ Institut National de la Statistique et de l'analyse Economique (INSAE) of Benin ; <https://www.insae-bj.org/>

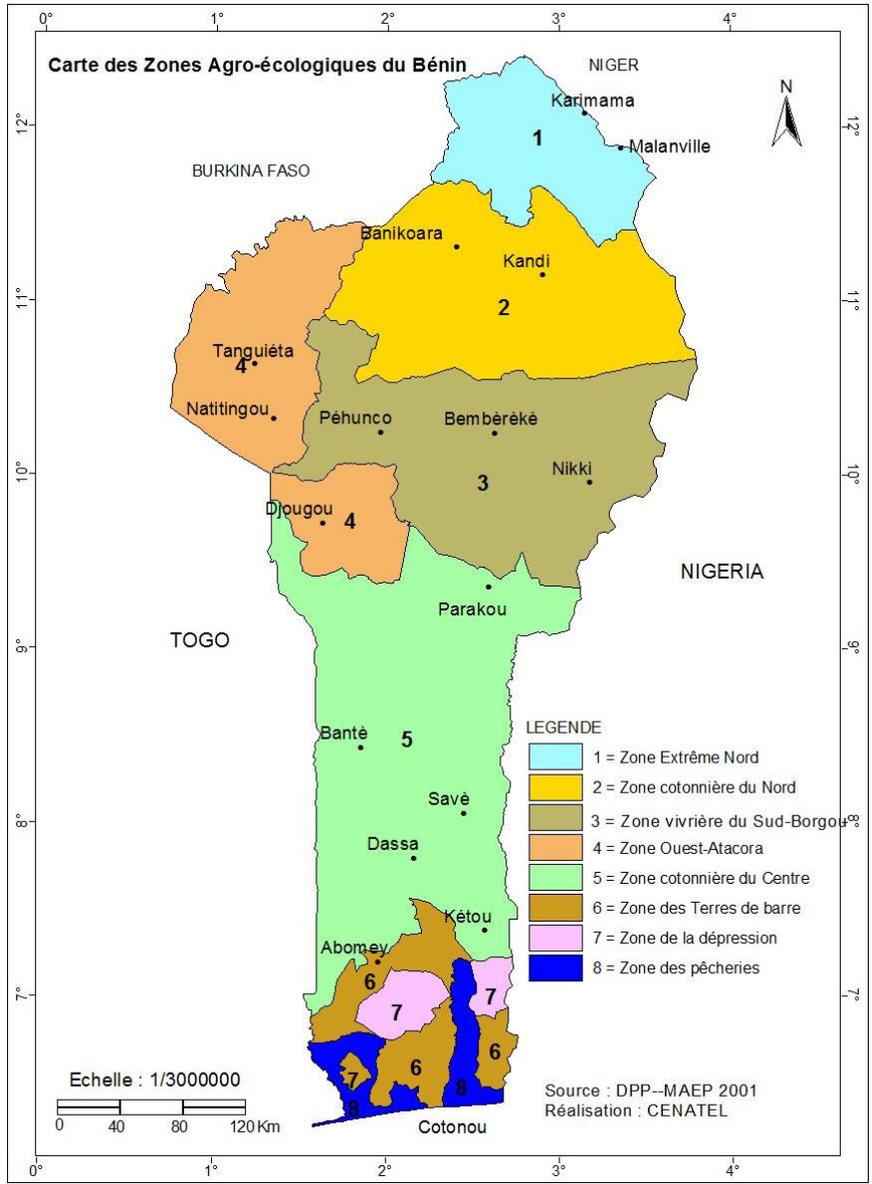


Figure 4: Agro-ecological Zones in Benin

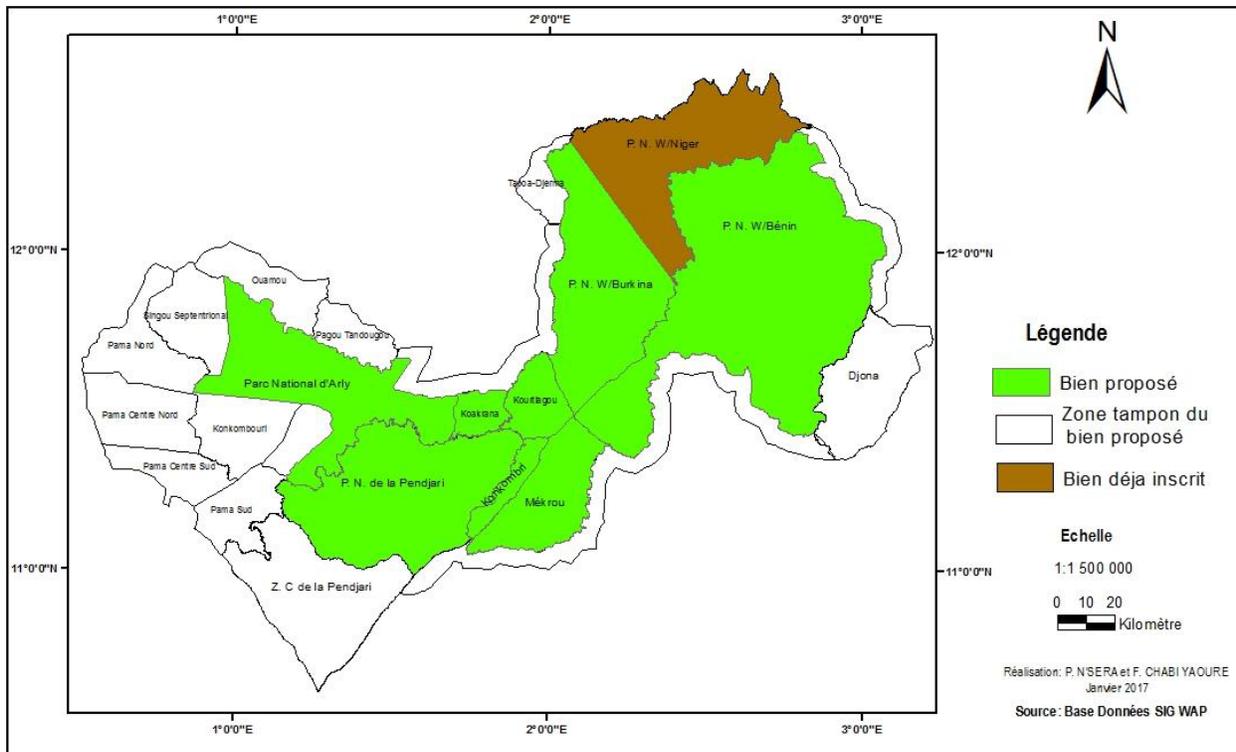


Figure 5: 2017 Updated Complex W-Arly-Pendjari and its buffer zone proposed for the IUCN patrimony inscription; Source UICN

8.3 TECHNICAL DESIGNS AND DRAWINGS

8.4 DOCUMENTATION OF STAKEHOLDER CONSULTATION

(1) Key Stakeholders identified

In Benin, during the SEA preparation and drafting process following stakeholders were identified to provide feedback on their particular concerns and priorities:

- USAID and PMI partners, the Mission Environmental Officer
- Ministry of Environment, Ministry of Health, Ministry of Agriculture

(2) National agencies such as National Parcs Agency, environmental Evaluation Agency and ; Means of identification and consultations

A short-term technical assistance trip was made to Benin by the PMI VectorLink Regional Environmental Compliance Manager (RECM), Sana Diop Dieng, under the supervision of Peter Chandonait, PMI VectorLink Director of Environmental Compliance and Safety, in order to meet with major stakeholders and gather the information necessary for the SEA preparation. During the first week, the RECM met with the USAID Mission in Benin, health structures and decentralized services at the field level to discuss the purpose of the visit and to receive any relevant guidance with regard to the SEA.

During the STTA and preparation activities Mrs Sana Diop Dieng identified these principal points for the document completion:

- The updated document of the human resources and physical facilities for, and the organizational commitment to IRS environmental and safety risk mitigation in the various districts;
- The Updated information on the protected areas around the regions, whether or not they are populated, and the laws and regulations pertinent to activities such as IRS within those areas;
- The description of the current regulatory structure for buffer zones around core areas, such as the International Union for Conservation of Nature (IUCN) structure or World Heritage UNESCO sites; and
- The updated information on the current registration status of WHO- recommended insecticides, and practices for the procurement, transport, storage, and handling of them, including the capacity and facilities for environmentally responsible disposal of various IRS wastes and contaminated products

(3) Stakeholder meeting notes and comments

Mrs Sana Diop Dieng accompanied by the VL Benin Environmental Compliance Officer, met USAID/PMI team, the relevant government partners including the NMCP, the National Agency of Environment (Agence Beninoise de l'Environnement) and the Service of Plant Protection (service de la Protection des Végétaux) to receive their input and feedback about their recent experience with our IRS program, as well as to gather any information about stakeholders' impressions and acceptance of IRS. Field visits consisted of meeting with districts' and health centers' officials, Regional directorate of Environment and other administrative responsible.

The RECM had briefing meetings with local PMI/USAID and CREC. During those meeting objectives of the STTA and activities done were presented for observations/recommendations to complete the trip and documents and mainly to discuss on challenges uncured by the project.

The main recommendation from stakeholders is to update the document with new component and to implement the IRS activities taking into account those updates

The table in Annex E comprises the names of the people who were interviewed during the preparation of the SEA.

ANNEX

ANNEX A: ENVIRONMENTAL MITIGATION AND MONITORING PLAN (EMMP)

PMI VECTORLINK PROJECT (AID-OAA-TO-17-00027)

Category of Activity from the Prevention of Mosquito-Borne Diseases through Vector Control IDIQ IEE	Describe specific environmental threats of your organization's activities	Description of Mitigation Measures for these activities	Who is responsible for monitoring?	Monitoring Indicator	Monitoring Method	Frequency of Monitoring
1. Education, Technical Assistance, Training	Activities involving studies, education, technical assistance, training, or information transfer, except to the extent they directly affect the environment (such as construction of facilities), are recommended for categorical	N/A – Categorical Exclusion	N/A	N/A	N/A	N/A

Category of Activity from the Prevention of Mosquito-Borne Diseases through Vector Control IDIQ IEE	Describe specific environmental threats of your organization's activities	Description of Mitigation Measures for these activities	Who is responsible for monitoring?	Monitoring Indicator	Monitoring Method	Frequency of Monitoring
	exclusion.					
2. Research and Development	Entomological surveillance and vector control research use laboratory equipment, chemical reagents, insecticides, and entomological surveillance supplies that have the potential to cause adverse health and environmental impacts if not properly managed. These materials require special care and management to	<ul style="list-style-type: none"> Implement laboratory environmental, health, and safety (EHS) manuals with standard operating procedures (SOPs), or use existing SOPs, for laboratory operations in accordance with country-specific compliance mechanisms. Implement SOPs for the safe storage, transport, and use of equipment, chemical reagents, insecticides, and supplies in conformance with international best practices (e.g., WHO, FAO) and host country requirements. Provide training to workers on the approved SOPs or Waste Management Plan (WMP) developed for properly handling and disposing of wastes. 	Laboratory personnel within the respective country, with oversight provided by Abt Associates technical experts.	<ul style="list-style-type: none"> EHS manual/Standard operating procedures (SOPs) implemented per PMI and country-specific requirements Training of staff in activities related to the laboratory EHS manual/SOPs 	<ul style="list-style-type: none"> Review of EHS manual/SOPs to ensure it is appropriate, and complies with PMI, WHO and country-specific recommendations for safety, use of personal protective equipment(if needed), spill prevention, and training. Review training materials and logs to verify trainings were conducted Confirm during routine visits 	<ul style="list-style-type: none"> Routine site visits, as needed, to ensure accordance with operating plan

Category of Activity from the Prevention of Mosquito-Borne Diseases through Vector Control IDIQ IEE	Describe specific environmental threats of your organization's activities	Description of Mitigation Measures for these activities	Who is responsible for monitoring?	Monitoring Indicator	Monitoring Method	Frequency of Monitoring
	minimize their expiration and/or damage.				<p>that SOPs are being effectively implemented and that workers are reporting EHS incidents</p> <ul style="list-style-type: none"> • Include date of visits, findings and any non-compliance issues in the annual EMMR • Include photographs from site visits 	
3. Public Health Commodities	N/A	N/A	N/A	N/A	N/A	N/A
4. Small-Scale Construction	<ul style="list-style-type: none"> • Lack of necessary permits and assessments in place in advance • Improper siting or construction techniques causing: 	<ul style="list-style-type: none"> • Obtain all needed authorizations prior to construction: permits, environmental and social impact assessments, etc. • Retain competent, licensed professionals to design and supervise construction 	Abt Associates technical overseers and Environmental	<ul style="list-style-type: none"> • Permits on file • Construction contracts are in place for engaged professionals and reflect requirements of USAID guidelines 	<ul style="list-style-type: none"> • Review all demolition, emergency, safety, waste management, and construction plans and contracts prior 	Pre-, mid- and post construction. Inspect construction sites at least

Category of Activity from the Prevention of Mosquito-Borne Diseases through Vector Control IDIQ IEE	Describe specific environmental threats of your organization's activities	Description of Mitigation Measures for these activities	Who is responsible for monitoring?	Monitoring Indicator	Monitoring Method	Frequency of Monitoring
	<ul style="list-style-type: none"> - Deterioration of human and social environments: - Erosion or sedimentation - Creation of disease vector habitat • Use of construction equipment can cause injuries to workers and bystanders. • Construction activities during renovation of facilities may generate debris and wastes that contain both non-hazardous and hazardous materials that require proper disposal. This includes chemicals, solvents, and any 	<ul style="list-style-type: none"> • Establish health, safety and environmental obligations in all contracts. • Complete a site emergency action plan • Provide safety training to all workers using construction equipment • Identify closest health care facility to handle injuries • Asbestos, lead based paints and other toxic materials will not be used under any circumstances. If the presence of asbestos is suspected in a facility to be renovated, the facility must be tested before rehabilitation works begins. Should asbestos be present, then the work must be carried out in conformity with host country requirements and with guidance to be provided by the Implementing Partner. All results of the testing for asbestos shall be communicated to the COR • Develop and follow a waste management plan (WMP). 	<p>Compliance Officers, with assistance from USAID Mission personnel. Contractors</p>	<p>for small-scale construction</p> <ul style="list-style-type: none"> • Waste management plan in place and being followed to identify and characterize all waste streams from the project with the proposed final disposal option • SOPs implemented • Staff briefings on activities related to SOPs 	<p>to renovations.</p> <ul style="list-style-type: none"> • Provide continual oversight of operations by regular site inspection visits. Review WMP to ensure it is adequate • Review records to verify trainings/ briefings were conducted 	<p>weekly</p>

Category of Activity from the Prevention of Mosquito-Borne Diseases through Vector Control IDIQ IEE	Describe specific environmental threats of your organization's activities	Description of Mitigation Measures for these activities	Who is responsible for monitoring?	Monitoring Indicator	Monitoring Method	Frequency of Monitoring
	<p>materials containing toxics, such as asbestos, lead-based paint, and formaldehyde.</p> <ul style="list-style-type: none"> • Exposure to hazardous building materials during renovation activities can result in health impacts to workers. • Waste produced during the construction or refurbishment work can be harmful to the environment and human health. • Use of environmentally unsustainable construction materials such as wood can lead to 	<p>Identify authorized recycling or disposal facilities prior to generation of waste.</p> <ul style="list-style-type: none"> • Minimize the generation of waste by: <ul style="list-style-type: none"> - Correctly assessing material needs (not over-buying) - Reducing amount of packaging used by suppliers - Reusing material on site, such as use of discarded materials for leveling ground and filling trenches, etc. • Designate secure on-site waste storage facilities • Ensure all workers are trained and dispose of wastes properly. • Complete and track hazardous waste manifests for all shipments • Source all construction material from an ecologically safe provider. • Contractor must provide and all workers must use personal protective equipment (PPE) such as hardhats, footwear, dust mask, safety glasses and reflective vests, as needed. 				

Category of Activity from the Prevention of Mosquito-Borne Diseases through Vector Control IDIQ IEE	Describe specific environmental threats of your organization's activities	Description of Mitigation Measures for these activities	Who is responsible for monitoring?	Monitoring Indicator	Monitoring Method	Frequency of Monitoring
	<p>environmental degradation</p> <ul style="list-style-type: none"> • Lack of personal protective equipment may lead to accidents, injuries, or exposure of workers. • Construction activities may produce noise and air pollution • Construction activities can create standing water and breeding habitats for disease vectors. 	<ul style="list-style-type: none"> • Ensure first aid and spill clean-up kits are easily available • Contractors must comply with the "Small-Scale Construction" chapter of the USAID Sector Environmental Guidelines (www.usaidgems.org/sectorGuidelines.htm). • Contractor will provide drinking water, latrine and a handwashing station to workers. • Contractors will arrange working hours to minimize disruption to the community. • If needed, construct drainage canals and infiltration pits for management of storm water and prevention of soil erosion. • Post-construction: ensure leftover materials have been properly disposed of. 				
5. Small-Scale Water and Sanitation	N/A	N/A	N/A	N/A	N/A	N/A

Category of Activity from the Prevention of Mosquito-Borne Diseases through Vector Control IDIQ IEE	Describe specific environmental threats of your organization's activities	Description of Mitigation Measures for these activities	Who is responsible for monitoring?	Monitoring Indicator	Monitoring Method	Frequency of Monitoring
6. Nutrition	N/A	N/A	N/A	N/A	N/A	N/A
7. Vector Control - IRS	1. Health and environmental impacts may result due to inadequate quality control of insecticides (i.e. procuring non-approved insecticides, improper storage, or poor inventory management).	<ul style="list-style-type: none"> 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. Procurement and inventory logs must be maintained. Ensure storage facility and personal protective equipment (PPE) are appropriate for the active ingredient used and in accordance with approved SOPs. Distribute insecticides to facilities that can manage such commodities safely in storage, use, and disposal (i.e. in a manner generally equivalent to Implementing Partner's own SOPs/WMP) 	District Coordinator (DC), Operations Manager (OM), Abt Environmental Compliance Officer (ECO), Abt Vector Control Manager (VCM), Storekeepers (These positions are representative of the responsibilities required,	<ul style="list-style-type: none"> PMI BMPs reviewed and implemented Procurement and inventory logs maintained Proper PPE used by workers, if needed. Operations facilities are sited appropriately All insecticide management records are reviewed and maintained 	<ul style="list-style-type: none"> Inspection of facilities, conditions, PPE use, and logs Review of waste management records and storekeeper performance checklists. Verify that inspection reports and storage records are properly maintained and document verification in the annual EMMR. ECO performs mid-application inspections. 	<ul style="list-style-type: none"> Daily monitoring by storekeeper or site supervisor Weekly monitoring by DC Monthly review of procurement logs and inventories by OM

Category of Activity from the Prevention of Mosquito-Borne Diseases through Vector Control IDIQ IEE	Describe specific environmental threats of your organization's activities	Description of Mitigation Measures for these activities	Who is responsible for monitoring?	Monitoring Indicator	Monitoring Method	Frequency of Monitoring
			but may not reflect the exact job title.)		Verify that inspection reports are properly maintained and document verification in the annual EMMR	
	2. Occupational risks for workers involved in IRS campaigns.	<ul style="list-style-type: none"> • Inspect and certify vehicles used for insecticide or team transport prior to contract. • Train drivers • Ensure availability of cell phone, personal protective equipment (PPE) and spill kits during insecticide transportation. • Initial and 30-day pregnancy testing for female candidates for jobs with potential insecticide contact. • Health test all spray team members for duty fitness. • Procure, distribute, and train all workers with potential insecticide contact on the use of PPE. 	DC, OM, ECO, Chief of Party, and Abt Associates technical experts within the respective country	<p>a. Transport vehicles have a valid inspection certificate on-board.</p> <p>b. Drivers have a certificate of training completion.</p> <p>c. Transport vehicles are equipped with cell phone, spill kit, and PPE.</p>	<p>a-c. ECO inspection of vehicles in the field.</p> <p>d-e. ECO inspection of health records at operations sites.</p> <p>f-h. ECO performs pre-application inspections of inventories and training records, and mid-</p>	<p>a-c. 2 inspections per week.</p> <p>d-e. One inspection per campaign, additional inspection if new hires or more than 30 application days.</p>

Category of Activity from the Prevention of Mosquito-Borne Diseases through Vector Control IDIQ IEE	Describe specific environmental threats of your organization's activities	Description of Mitigation Measures for these activities	Who is responsible for monitoring?	Monitoring Indicator	Monitoring Method	Frequency of Monitoring
		<ul style="list-style-type: none"> • Train operators on mixing insecticides and the proper use and maintenance of application equipment. • Provide adequate facilities and supplies for end-of-day cleanup. • Enforce application and clean-up procedures. 		<p>d. Records are kept of pregnancy testing for all female team members.</p> <p>e. Records are kept of medical exam results for all team members.</p> <p>f. Operators wear complete PPE during application and clean-up, according to SOP requirements.</p> <p>g. Operators mix insecticide properly, and equipment does not leak.</p>	<p>application inspections of PPE use and operator performance.</p> <p>i. Monitoring of on-line database for submission of inspection reports.</p>	<p>f-h. ECO pre-application inspections 2 per campaign, ECO mid-application inspections 5 times per week.</p> <p>i. Weekly</p>

Category of Activity from the Prevention of Mosquito-Borne Diseases through Vector Control IDIQ IEE	Describe specific environmental threats of your organization's activities	Description of Mitigation Measures for these activities	Who is responsible for monitoring?	Monitoring Indicator	Monitoring Method	Frequency of Monitoring
				<p>h. All facilities are compliant, and materials required for clean-up are present.</p> <p>i. Inspections are performed as scheduled, corrective action is taken as needed.</p>		
	3. Health and safety risks for residents of treated houses (e.g., risks from skin contact and/or ingestion of insecticides)	a. Implement Information, Education and Communication (IEC) campaigns to inform homeowners of responsibilities and precautions, including washing itchy skin and going to health clinic if symptoms develop and do not subside	IEC officers, OM, ECO, host country Ministry of Health/Environment officials.	a. Review IEC materials and records and execute pre-application IEC campaigns	a. Review IEC materials and records to verify IEC pre-application campaigns were conducted and homeowners were informed of responsibilities	a. Review IEC materials once per campaign

Category of Activity from the Prevention of Mosquito-Borne Diseases through Vector Control IDIQ IEE	Describe specific environmental threats of your organization's activities	Description of Mitigation Measures for these activities	Who is responsible for monitoring?	Monitoring Indicator	Monitoring Method	Frequency of Monitoring
		b. Ensure health facility staff are aware of insecticide poisoning management			and precautions	
	4. Nearby residents may be exposed to insecticides if insecticides are not securely stored to prevent theft and misuse incidents, including the illegal resale of insecticides.	<ul style="list-style-type: none"> Storage facilities and transportation vehicles must be physically secured to prevent theft. Maintain records of all insecticide receipts, issuance, and return of empty containers. Conduct analysis comparing number of houses treated vs. number of containers used. Examine houses treated to confirm application Perform physical inventory counts during the application season. 	Storekeepers , District coordinators, sector managers, logistics coordinator, OM, ECO	<ul style="list-style-type: none"> Storage facilities and transportation vehicles are secured. All insecticide management records are reconciled. 	<ul style="list-style-type: none"> Inspection of storage facilities and transportation vehicles. Inspection of insecticide management records. Storekeeper performance checklists. ECO mid-campaign inspections. 	<ul style="list-style-type: none"> Daily monitoring by storekeeper or site supervisor. Weekly monitoring by District Coordinator Examine houses during campaign according to schedule in SOPs. Physical inventory counts twice per campaign per store room.

Category of Activity from the Prevention of Mosquito-Borne Diseases through Vector Control IDIQ IEE	Describe specific environmental threats of your organization's activities	Description of Mitigation Measures for these activities	Who is responsible for monitoring?	Monitoring Indicator	Monitoring Method	Frequency of Monitoring
	5. Ecological risk to non-target species and water bodies from use of insecticides	<ul style="list-style-type: none"> • For shipments of insecticide over water, sachets/ bottles will be packed in 220 liter open top barrels with a water-tight top and a locking ring, or in a similar durable container. Waterproof labeling must be affixed to the barrel, with the identity of the pesticide, number of bottles inside, the weight, the type of hazard posed by the contents, and the personal protective equipment to be worn when handling the barrel. • Train applicators on the SEA operational requirements, SOPs, PMI BMPs, and approved WMP, developed for the safe and effective storage, distribution, application, and disposal of insecticides • Ensure application equipment and PPE are appropriate for the active ingredient used and in accordance with approved 	DC, OM, ECO	<ul style="list-style-type: none"> • Training materials and records • Equipment is maintained and operated to eliminate leaks. • Applicators only mix and apply insecticides according to SOPs 	<ul style="list-style-type: none"> • Review training materials and records to verify trainings were conducted • Conduct inspections during operations. • Verify that inspection and incident reports are properly maintained and document verification in the annual EMMR. Include any issues identified during inspections in the annual EMMR 	<ul style="list-style-type: none"> • Inspect work records once per campaign • Inspections during operations 3 times per week • Review training materials once per campaign

Category of Activity from the Prevention of Mosquito-Borne Diseases through Vector Control IDIQ IEE	Describe specific environmental threats of your organization's activities	Description of Mitigation Measures for these activities	Who is responsible for monitoring?	Monitoring Indicator	Monitoring Method	Frequency of Monitoring
		<p>SOPs, and maintain equipment to avoid leaks.</p> <ul style="list-style-type: none"> • Maintain application equipment • No application of insecticides within 30 yards of beekeeping sites 				
	6. Environmental risk from disposal of liquid and solid wastes	<ul style="list-style-type: none"> • Handling, treatment, and disposal of nonhazardous (general waste) and hazardous wastes must be in accordance with the approved WMP/SOPs and the PMI BMPs. The WMP, which outlines SOPs for managing waste processes, must be in accordance with PMI best practices and host country requirements • Choose sites for disposal of liquid wastes, including fixed and mobile soak pit sites according to PMI BMPs • Construct fixed and mobile soak pits with charcoal according to the BMPs to adsorb insecticide from rinse water 	DC, OM, ECO	<ul style="list-style-type: none"> • WMP implemented and disposal sites inspected and certified before campaigns. • Disposal sites near operations sites are appropriate according to PMI BMPs • Soak pits are constructed according to PMI BMPs • Soak pits perform properly throughout the 	<ul style="list-style-type: none"> • Review WMP/SOPs to ensure it conforms to PMI BMPs and WMP is available on site • Pre-application inspections. Verify that inspection reports are properly maintained and document verification in the annual EMMR. Include any issues 	<ul style="list-style-type: none"> • Pre-application inspections: once per campaign • Mid- and post-application inspections: twice per campaign • Review of WMP/SOPs during campaign

Category of Activity from the Prevention of Mosquito-Borne Diseases through Vector Control IDIQ IEE	Describe specific environmental threats of your organization's activities	Description of Mitigation Measures for these activities	Who is responsible for monitoring?	Monitoring Indicator	Monitoring Method	Frequency of Monitoring
		<ul style="list-style-type: none"> • Maintain soak pits as necessary during season • Monitor waste storage and management during campaign • Monitor disposal procedures post-campaign 		<p>application season</p> <ul style="list-style-type: none"> • Wastes are stored and managed according to PMI BMPs • Waste disposal is conducted in accordance with the WMP/SOPs and records maintained 	<p>identified during inspections in the annual EMMR</p> <ul style="list-style-type: none"> • Mid- and post-application inspections and monitoring. Verify disposal practices in inspection reports and document in the annual EMMR. Include any issues identified during inspections in the annual EMMR. • Review WMP/SOPs to for effectiveness and maintain 	

Category of Activity from the Prevention of Mosquito-Borne Diseases through Vector Control IDIQ IEE	Describe specific environmental threats of your organization's activities	Description of Mitigation Measures for these activities	Who is responsible for monitoring?	Monitoring Indicator	Monitoring Method	Frequency of Monitoring
					on site	
	7. Improper incineration of wastes and disposal of residual ash can pose a threat to air quality, soil, and the water supply and result in environmental and public health hazards.	<ul style="list-style-type: none"> Wastes will only be disposed in incinerators that comply with PMI BMPs Collect and maintain treatment and disposal documents and records on file Country-level USAID EC documentation must contain guidance on proper disposal of wastes 	COR, Abt ECO, Abt Technical Experts	<ul style="list-style-type: none"> Incinerator specifications Maintenance of treatment and disposal records Reg 216 documentation for incinerator procurement and management services reviewed by COR and GH BEO. 	<ul style="list-style-type: none"> Review incineration records and document in the annual EMMR 	<ul style="list-style-type: none"> Review incinerator specifications prior to disposal arrangement Annual review of disposal records
7. Vector Control - Testing of Insecticide-Treated Nets.	1. Risk of theft from storerooms, followed by unintended use.	1. Store nets only in storerooms secured with sturdy doors, locks, and barred windows.	Environmental Compliance Officer, USAID Mission	1. Storerooms are secure with sturdy doors, locks, and barred windows..	1. Inspection of storeroom for required features	1-2. Once per activity (e.g., campaign) or per fiscal semester.
7. Vector Control -	1. Misuse of non-expired ITNs (i.e.,	Where there is evidence of misuse for fishing, assess the	Abt Associates	Key messages in place to reinforce	Verification of	Continuously when

Category of Activity from the Prevention of Mosquito-Borne Diseases through Vector Control IDIQ IEE	Describe specific environmental threats of your organization's activities	Description of Mitigation Measures for these activities	Who is responsible for monitoring?	Monitoring Indicator	Monitoring Method	Frequency of Monitoring
Distribution of Insecticide-treated Nets Applies only in countries where VectorLink distributes ITNs to beneficiaries and is responsible for ITN transport, storage, distribution, disposal and/or SBC activities.	nets used for non-public health purposes such as fishing)	extent of misuse and collaborate across sectors (Ministries of Health, Environment, and Agriculture) to develop a sustainable, locally relevant solution	ECO and country senior staff where ITNs are delivered at scale and fishing occurs.	appropriate ITN use, particularly in areas where ITNs are delivered at scale and fishing is practiced.	key messages.	personnel are in the field
	2. Reduced efficacy of LLINs due to improper storage	Store LLINs in dry, ventilated facilities	ECO, store manager	Confirmed evidence of ITN storage consistent with country-specific and established guidelines	Visual observation and evidence (photos) of storage capacity, security, conditions	Continuous observation
	3. Pilferage of LLINs and consequential human and environmental exposure	Store in a secure facility to prevent theft or unauthorized access. Post guard or use barred windows as needed	ECO, store manager	Visual and physical evidence of the security of windows and doors	Visual observation and physical testing of the security of windows and doors	Continuous by store manager, bi-annual by ECO

Category of Activity from the Prevention of Mosquito-Borne Diseases through Vector Control IDIQ IEE	Describe specific environmental threats of your organization's activities	Description of Mitigation Measures for these activities	Who is responsible for monitoring?	Monitoring Indicator	Monitoring Method	Frequency of Monitoring
	4. Contamination of edible or potable materials due to contact with ITNs	Do not store LLINs with food, feed, or potable water supplies	Store manager, ECO	Presence or absence of sensitive materials stored with LLINs	Visual observation	Continuous monitoring by store manager, 4 times/yr by ECO
	5. Worker safety (handling LLINs that are not individually packaged)	Provide worker training on the proper handling of LLINs	ECO, store manager	ITN handling knowledge assessed among distribution agents	Interviews with workers	Prior to engaging workers for distribution of nets.
	6. Human and environmental impacts of washing LLINs	Ensure that SBCC materials and outreach activities are coordinated with ITN distribution activities during campaigns, and include guidelines on how to properly wash and maintain LLINs (e.g., discourage disposal of wash water in sensitive ecosystems, discourage washing and rinsing LLINs in	IEC coordinator, ECO	Key messages developed to reinforce correct ITN wash practices	Review of ITN key messages with campaign/health personnel	Upon distribution of nets, 4 times/yr. by ECO

Category of Activity from the Prevention of Mosquito-Borne Diseases through Vector Control IDIQ IEE	Describe specific environmental threats of your organization's activities	Description of Mitigation Measures for these activities	Who is responsible for monitoring?	Monitoring Indicator	Monitoring Method	Frequency of Monitoring
		water bodies)				
	7. Human and environmental impacts of bags and baling materials used to package LLINs	Ensure that SBCC messages inform campaign distributors and local communities about the potential harm to human health and environment if bags and baling materials are reused; support the development of a communication plan that provides messages on best practices for handling and disposing of bags and baling materials.	IEC coordinator, ECO	Presence or absence of SBC materials on best practices included in MOH communication plans or materials developed with VectorLink support.	Visual observation of MOH plans, materials developed with VectorLink support	Annually.
8. Emergency Response	N/A	N/A	N/A	N/A	N/A	N/A

Category of Activity from the Prevention of Mosquito-Borne Diseases through Vector Control IDIQ IEE	Describe specific environmental threats of your organization's activities	Description of Mitigation Measures for these activities	Who is responsible for monitoring?	Monitoring Indicator	Monitoring Method	Frequency of Monitoring

ANNEX B: ENVIRONMENTAL MITIGATION AND MONITORING REPORT FORM

PMI VECTOR LINK Benin PROJECT
Implementing Organization: Abt Associates
Geographic location of USAID-funded activities:
Period covered by this Reporting Form and Certification:

List each Mitigation Measure from column 3 in the EMMP (EMMT Part 2 of 3)	Status of Mitigation Measures	List any outstanding issues relating to required conditions	Remarks
<p>2. Research and Development</p> <ul style="list-style-type: none"> • Implement laboratory environmental, health, and safety (EHS) manuals with standard operating procedures (SOPs), or use existing SOPs, for laboratory operations in accordance with country-specific compliance mechanisms. • Implement SOPs for the safe storage, transport, and use of equipment, chemical reagents, insecticides, and supplies in conformance with international best practices (e.g., WHO, FAO) and host country requirements. • Provide training to workers on the approved SOPs or Waste Management Plan (WMP) developed for properly handling and disposing of wastes. 			
<p>4. Small-Scale Construction</p> <ul style="list-style-type: none"> • Obtain all needed authorizations prior to construction: permits, environmental and social impact assessments, etc. • Retain competent, licensed professionals to design and supervise construction 			

<p align="center">List each Mitigation Measure from column 3 in the EMMP (EMMT Part 2 of 3)</p>	<p align="center">Status of Mitigation Measures</p>	<p align="center">List any outstanding issues relating to required conditions</p>	<p align="center">Remarks</p>
<ul style="list-style-type: none"> • Establish health, safety and environmental obligations in all contracts. • Complete a site emergency action plan • Provide safety training to all workers using construction equipment • Identify closest health care facility to handle injuries • Asbestos, lead based paints and other toxic materials will not be used under any circumstances. If the presence of asbestos is suspected in a facility to be renovated, the facility must be tested before rehabilitation works begins. Should asbestos be present, then the work must be carried out in conformity with host country requirements and with guidance to be provided by the Implementing Partner. All results of the testing for asbestos shall be communicated to the COR • Develop and follow a waste management plan (WMP). Identify authorized recycling or disposal facilities prior to generation of waste. • Minimize the generation of waste by: <ul style="list-style-type: none"> - Correctly assessing material needs (not over-buying) - Reducing amount of packaging used by suppliers - Reusing material on site, such as use of discarded materials for leveling ground and filling trenches, etc. • Designate secure on-site waste storage facilities • Ensure all workers are trained and dispose of wastes properly. • Complete and track hazardous waste manifests for all shipments 			

<p>List each Mitigation Measure from column 3 in the EMMP</p> <p>(EMMT Part 2 of 3)</p>	<p>Status of Mitigation Measures</p>	<p>List any outstanding issues relating to required conditions</p>	<p>Remarks</p>
<ul style="list-style-type: none"> • Source all construction material from an ecologically safe provider. • Contractor must provide and all workers must use personal protective equipment (PPE) such as hardhats, footwear, dust mask, safety glasses and reflective vests, as needed. • Ensure first aid and spill clean-up kits are easily available • Contractors must comply with the “Small-Scale Construction” chapter of the USAID Sector Environmental Guidelines (https://www.usaid.gov/environmental-procedures/sectoral-environmental-social-best-practices/seg-construction/pdf). • Contractor will provide drinking water, latrine and a handwashing station to workers. • Contractors will arrange working hours to minimize disruption to the community. • If needed, construct drainage canals and infiltration pits for management of storm water and prevention of soil erosion. • Post-construction: ensure leftover materials have been properly disposed of. 			
<p>7a. Indoor Residual Spraying</p> <ul style="list-style-type: none"> • 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. • Procurement and inventory logs must be maintained. 			

<p>List each Mitigation Measure from column 3 in the EMMP</p> <p>(EMMT Part 2 of 3)</p>	<p>Status of Mitigation Measures</p>	<p>List any outstanding issues relating to required conditions</p>	<p>Remarks</p>
<ul style="list-style-type: none"> • Ensure storage facility and personal protective equipment (PPE) are appropriate for the active ingredient used and in accordance with approved SOPs. • Distribute insecticides to facilities that can manage such commodities safely in storage, use, and disposal (i.e. in a manner generally equivalent to Implementing Partner's own SOPs/WMP) 			
<ul style="list-style-type: none"> • Inspect and certify vehicles used for insecticide or team transport prior to contract. • Train drivers • Ensure availability of cell phone, personal protective equipment (PPE) and spill kits during insecticide transportation. • Initial and 30-day pregnancy testing for female candidates for jobs with potential insecticide contact. • Health test all spray team members for duty fitness. • Procure, distribute, and train all workers with potential insecticide contact on the use of PPE. • Train operators on mixing insecticides and the proper use and maintenance of application equipment. • Provide adequate facilities and supplies for end-of-day cleanup. • Enforce application and clean-up procedures. 			

<p>List each Mitigation Measure from column 3 in the EMMP</p> <p>(EMMT Part 2 of 3)</p>	<p>Status of Mitigation Measures</p>	<p>List any outstanding issues relating to required conditions</p>	<p>Remarks</p>
<ul style="list-style-type: none"> • Implement Information, Education and Communication (IEC) campaigns to inform homeowners of responsibilities and precautions, including washing itchy skin and going to health clinic if symptoms develop and do not subside • Ensure health facility staff are aware of insecticide poisoning management 			
<ul style="list-style-type: none"> • Storage facilities and transportation vehicles must be physically secured to prevent theft. • Maintain records of all insecticide receipts, issuance, and return of empty containers. • Conduct analysis comparing number of houses treated vs. number of containers used. • Examine houses treated to confirm application • Perform physical inventory counts during the application season. 			
<ul style="list-style-type: none"> • For shipments of insecticide over water, sachets/ bottles will be packed in 220 liter open top barrels with a water-tight top and a locking ring, or in a similar durable container. Waterproof labeling must be affixed to the barrel, with the identity of the pesticide, number of bottles inside, the weight, the type of hazard posed by the contents, and the personal protective equipment to be worn when handling the barrel. • Train applicators on the SEA operational requirements, SOPs, PMI BMPs, and 			

<p>List each Mitigation Measure from column 3 in the EMMP</p> <p>(EMMT Part 2 of 3)</p>	<p>Status of Mitigation Measures</p>	<p>List any outstanding issues relating to required conditions</p>	<p>Remarks</p>
<p>approved WMP, developed for the safe and effective storage, distribution, application, and disposal of insecticides</p> <ul style="list-style-type: none"> • Ensure application equipment and PPE are appropriate for the active ingredient used and in accordance with approved SOPs, and maintain equipment to avoid leaks. • Maintain application equipment • No application of insecticides within 30 yards of beekeeping sites 			
<ul style="list-style-type: none"> • Handling, treatment, and disposal of nonhazardous (general waste) and hazardous wastes must be in accordance with the approved WMP/SOPs and the PMI BMPs. The WMP, which outlines SOPs for managing waste processes, must be in accordance with PMI best practices and host country requirements • Choose sites for disposal of liquid wastes, including fixed and mobile soak pit sites according to PMI BMPs • Construct fixed and mobile soak pits with charcoal according to the BMPs to adsorb insecticide from rinse water • Maintain soak pits as necessary during season • Monitor waste storage and management during campaign • Monitor disposal procedures post-campaign 			
<ul style="list-style-type: none"> • Wastes will only be disposed in incinerators that comply with PMI BMPs Collect and maintain treatment and disposal documents and records on file 			

List each Mitigation Measure from column 3 in the EMMP (EMMT Part 2 of 3)	Status of Mitigation Measures	List any outstanding issues relating to required conditions	Remarks
<ul style="list-style-type: none"> Country-level USAID EC documentation must contain guidance on proper disposal of wastes 			
<p>7b. Testing of ITNs</p> <ul style="list-style-type: none"> Store nets only in storerooms secured with sturdy doors, locks, and barred windows. 			
<p>7c. Distribution of ITNs</p> <ul style="list-style-type: none"> Where there is evidence of misuse for fishing, assess the extent of misuse and collaborate across sectors (Ministries of Health, Environment, and Agriculture) to develop a sustainable, locally relevant solution 			
<ul style="list-style-type: none"> Store LLINs in dry, ventilated facilities 			
<ul style="list-style-type: none"> Store in a secure facility to prevent theft or unauthorized access. Post guard or use barred windows as needed 			
<ul style="list-style-type: none"> Do not store LLINs with food, feed, or potable water supplies 			
<ul style="list-style-type: none"> Provide worker training on the proper handling of LLINs 			
<ul style="list-style-type: none"> Ensure that SBCC materials and outreach activities are coordinated with ITN distribution activities during campaigns, and include guidelines on how to properly wash 			

List each Mitigation Measure from column 3 in the EMMP (EMMT Part 2 of 3)	Status of Mitigation Measures	List any outstanding issues relating to required conditions	Remarks
and maintain LLINs (e.g., discourage disposal of wash water in sensitive ecosystems, discourage washing and rinsing LLINs in water bodies)			
<ul style="list-style-type: none"> • Ensure that SBCC messages inform campaign distributors and local communities about the potential harm to human health and environment if bags and baling materials are reused; support the development of a communication plan that provides messages on best practices for handling and disposing of bags and baling materials. 			

ANNEX C: SUMMARY OF ACUTE EXPOSURE SYMPTOMS & TREATMENT OF IRS PESTICIDES

Summary of Acute Exposure Symptoms and Treatment of WHO-Recommended Carbamate

Carbamates	Human Side Effects	Treatment
Bendiocarb	Excessive sweating, headache, nausea, blurred vision, chest pain, vomiting, excessive salivation, and slurred speech. Severe intoxication causes narrowed pupils, muscle twitching, spasms, intestinal convulsions, diarrhea, and labored respiration.	The affected person should stop work immediately, remove any contaminated clothing, and wash the affected skin with soap and clean water. The whole contaminated area (including the eyes, if necessary) should be flushed with large quantities of clean water. The patient should be kept at rest and immediate medical aid obtained. Administer atropine.
Propoxur	Excessive sweating, headache, nausea, blurred vision, chest pain, vomiting, excessive salivation, and slurred speech. Severe intoxication causes narrowed pupils, muscle twitching, spasms, intestinal convulsions, diarrhea, and labored respiration.	The affected person should stop work immediately, remove any contaminated clothing, and wash the affected skin with soap and clean water. The whole contaminated area (including the eyes, if necessary) should be flushed with large quantities of clean water. The patient should be kept at rest and immediate medical aid obtained. Administer atropine.

Summary of Acute Exposure Symptoms and Treatment of WHO-Recommended Organophosphates

Organophosphate	Human Side Effects	Treatment
Malathion	<p>Malathion is an indirect cholinesterase inhibitor. The primary target of malathion is the nervous system; it causes neurological effects by inhibiting cholinesterase.</p> <p>Exposure to high levels can result in difficulty breathing, vomiting, blurred vision, increased salivation and perspiration, headaches, and dizziness. Loss of consciousness and death may follow very high exposures to malathion.</p>	<p>Oral exposure to malathion should be treated with rapid gastric lavage unless the patient is vomiting. Dermal exposures should be treated by washing the affected area with soap and water. If the eyes have been exposed to malathion, flush them with saline solution or water. People exposed to malathion who exhibit respiratory inefficiency with peripheral symptoms should be treated via slow intravenous injection with 2–4 mg atropine sulfate and 1,000–2,000 mg pralidoxime chloride or 250 mg toxogonin (adult dose).</p> <p>Exposure to high levels of malathion that result in respiratory distress, convulsions, and unconsciousness should be treated with atropine and a re-activator. Morphine, barbiturates, phenothiazine, tranquilizers, and central nervous system stimulants are all contraindicated.</p>
Fenitrothion	<p>Fenitrothion is the most toxic to humans of the insecticides recommended for residual house spraying, and has a relatively low margin of safety.</p> <p>It is absorbed through the gastrointestinal tract as well as through intact skin and by inhalation and a cholinesterase inhibitor.</p>	<p>Dermal exposure to fenitrothion should be treated by removing contaminated clothing, rinsing the skin with water, washing the exposed areas with soap and water, then seeking medical attention. If fenitrothion gets into the eyes, they should be rinsed with water for several minutes.</p> <p>Contact lenses should be removed if possible and medical attention should be sought.</p> <p>Ingestion of fenitrothion should be treated by rinsing the mouth and inducing vomiting if the person is conscious. Inhalation exposures require removal to fresh air and rest in a half-upright position. Artificial respiration should be administered if indicated, and medical attention should be sought.</p>
Pirimiphos-methyl	<p>Pirimiphos-methyl is also a cholinesterase inhibitor. Early symptoms of poisoning may include excessive sweating, headache, weakness, giddiness, nausea, vomiting,</p>	<p>Organophosphate poisoning is a medical emergency and requires immediate treatment. All supervisors and individual spray operators (in the case of dispersed operations) should be trained</p>

Organophosphate	Human Side Effects	Treatment
	<p>stomach pains, blurred vision, constricted pupils, slurred speech, and muscle twitching. Later there may be convulsions, coma, loss of reflexes, and loss of sphincter control.</p>	<p>in first-aid and emergency treatment of organophosphate intoxication.</p> <p>The affected person should stop work immediately, remove any contaminated clothing, wash the affected skin with soap and clean water, and flush the skin with large quantities of clean water. Care must be taken not to contaminate others, including medical or paramedical workers.</p> <p>Atropine sulfate: Administer atropine sulfate intravenously, or intramuscularly if intravenous injection is not possible.</p> <p>Glycopyrolate has been studied as an alternative to atropine and found to have similar outcomes using continuous infusion.</p>

Summary of Acute Exposure Symptoms and Treatment of WHO-Recommended Pyrethroids

Pyrethroids	Human Side Effects	Treatment
Bifenthrin	<p>Acute exposure symptoms include skin and eye irritation, headache, dizziness, nausea, vomiting, diarrhea, excessive salivation, fatigue, irritability, abnormal sensations of the face and skin, and numbness.</p> <p>No skin inflammation or irritation observed; however, can cause a reversible tingling sensation.</p> <p>Incoordination, irritability to sound and touch, tremors, salivation, diarrhea, and vomiting have been caused by high doses.</p>	<p>Depends on the symptoms of the exposed person. Casual exposures require decontamination and supportive care. Wash affected skin areas promptly with soap and warm water.</p> <p>Medical attention should be sought if irritation or paresthesia occurs. Eye exposures should be treated by rinsing with copious amounts of water or saline.</p>
Deltamethrin	<p>Deltamethrin is a powerful broad-spectrum synthetic pyrethroid. It is of moderate toxicity to mammals as it is rapidly metabolized and does not accumulate. It poses low risk to humans when used at levels recommended for its designed purpose. Deltamethrin exhibits its toxic effects by affecting the way the nerves and brain normally function by interfering with the sodium channels of nerve cells.</p> <p>Typical symptoms of acute exposure are irritation of skin and eyes and neurological effects such as severe headaches, dizziness, nausea, anorexia, vomiting, diarrhea, excessive salivation, fatigue, irritability, abnormal sensations of the face and skin, and numbness. Tremors and convulsions have been reported in severe poisonings. Inhaled</p>	<p>If exposed immediately remove any contaminated clothing. Soak any liquid contaminant on the skin; clean affected area with soap and warm water.</p> <p>Rinse copiously with water when eye exposures occur, or with 4% sodium bicarbonate.</p> <p>Vomiting should not be induced following ingestion exposures, but the mouth should be rinsed.</p>

Pyrethroids	Human Side Effects	Treatment
	<p>deltamethrin has been shown to cause reversible cutaneous paresthesia (a burning, tingling, or stinging of the skin). Limited data exist for humans following chronic exposures. However, the following effects are suspected to be a result of chronic exposures in humans: choreoathetosis, hypotension, prenatal damage, and shock. Chronic occupational exposure to deltamethrin causes skin and eye irritation. IARC has classified deltamethrin as “not classifiable as to its carcinogenicity in humans.”</p>	
<p>Lambda-cyhalothrin</p>	<p>Skin exposure leads to transient skin sensations such as periorbital facial tingling and burning.</p> <p>Can irritate the eyes, skin, and upper respiratory tract. Oral exposure can cause neurological effects, including tremors and convulsions.</p> <p>Ingestion of liquid formulations may result in aspiration of the solvent into the lungs, resulting in chemical pneumonitis.</p>	<p>Dermal exposure should be treated by removing contaminated clothing and washing the exposed areas with soap and water. Eyes should be rinsed with water for several minutes. Vomiting should not be induced following ingestion. Inhalation exposures require removal to fresh air and rest.</p>
<p>Alpha-cypermethrin</p>	<p>Acute exposure symptoms include skin rashes, eye irritation, itching and burning sensation on exposed skin, and paraesthesia.</p> <p>Acute inhalation exposures may cause upper and lower respiratory tract irritation. Ingestion of alpha-cypermethrin is also harmful.</p>	<p>Dermal exposure should be treated by removing contaminated clothing and washing the exposed areas with soap and water. Eyes should be rinsed with water for several minutes. Vomiting should not be induced following ingestion. Inhalation exposures require removal to fresh air and rest.</p>

Pyrethroids	Human Side Effects	Treatment
Cyfluthrin	Acute occupational or accidental exposure results in burning, itching, and tingling of the skin. Reported systemic symptoms included dizziness, headache, anorexia, and fatigue. Vomiting occurs most commonly after ingestion of pyrethroids. Less commonly reported symptoms include tightness of the chest, paresthesia, palpitations, blurred vision, and increased sweating. In serious cases, coarse muscular twitching, convulsions, and coma.	If exposed, immediately remove any contaminated clothing. Soak any liquid contaminant on the skin; clean affected area with soap and warm water. Rinse copiously with water when eye exposures occur, or with 4% sodium bicarbonate. Vomiting should not be induced following ingestion exposures, but the mouth should be rinsed.
Etofenprox	Acute occupational or accidental exposure results in burning, itching, and tingling of the skin. Reported systemic symptoms included dizziness, headache, anorexia, and fatigue. Vomiting occurs most commonly after ingestion of pyrethroids. Less commonly reported symptoms include tightness of the chest, paresthesia, palpitations, blurred vision, and increased sweating. In serious cases, coarse muscular twitching, convulsions, and coma may occur.	If exposed, immediately remove any contaminated clothing. Soak any liquid contaminant on the skin; clean affected area with soap and warm water. Rinse copiously with water when eye exposures occur, or with 4% sodium bicarbonate. Vomiting should not be induced following ingestion exposures, but the mouth should be rinsed.

Summary of Acute Exposure Symptoms and Treatment for Chlorfenapyr

Human side	Treatment
<p>As chlorfenapyr is a rather new product there are not many cases of poisonings where the symptoms were described. One patient first exhibited general fatigue, hyper-perspiration, nausea, and vomiting. He was initially diagnosed as being dehydrated.</p> <p>Another patient initially presented with hyper-perspiration, headache, and cough. Symptomatic management was initiated, but after seven days she suffered neurological and respiratory deterioration, causing her death.</p>	<p>Symptoms following exposure should be observed in a controlled setting until all signs and symptoms have been fully resolved. If the substance was ingested, control any seizures first. Chlorfenapyr can produce abnormalities of the hematopoietic system, liver, and kidneys. Do not use emetics.</p> <p>Monitoring complete blood count, urinalysis, and liver and kidney function tests is suggested for patients with significant exposure. If respiratory tract irritation or respiratory depression is evident from inhalation, monitor arterial blood gases, chest x-ray, and pulmonary function tests.</p> <p>Significant esophageal or gastro-intestinal tract irritation or burns may occur following ingestion. Consider gastric lavage after ingestion of a potentially life-threatening amount of poison if it can be performed soon after ingestion (generally within 1 hour). Protect airway by placement in Trendelenburg and left lateral decubitus position or by endotracheal intubation.</p> <p>Activated charcoal binds most toxic agents and can decrease their systemic absorption if administered soon after ingestion. Immediate dilution with milk or water may be of benefit in caustic or irritant chemical ingestions. Rinse mouth and administer 5 ml/kg up to 200 ml of water for dilution if the patient can swallow, has a strong gag reflex, and does not drool.</p> <p>Observe patients with ingestion carefully for the possible development of esophageal or gastrointestinal tract irritation or burns. If signs or symptoms of esophageal irritation or burns are present, consider endoscopy to determine the extent of injury.</p> <p>Carefully observe patients with inhalation exposure for the development of any systemic signs or symptoms, and administer symptomatic treatment as necessary. If exposure is to the eyes, immediately irrigate exposed eyes with copious amounts of room temperature water (better with 0.9% saline solution) for at least 15 minutes. If irritation, pain, swelling, lacrimation, or photophobia persist, the patient should be seen in a health care facility.</p> <p>For dermal exposure, remove contaminated clothing and wash exposed area thoroughly with soap and water. A physician may need to examine the area if irritation or pain persists.</p>

Summary of Acute Exposure Symptoms of Exposure to and Treatment of Clothianidin

Human Side Effects	Treatment
<p>Clothianidin is a systemic insecticide belonging to the nitroguanidine subgroup of nicotinoid insecticides. It is also referred to as a chloronicotinyl or neonicotinoid. Clothianidin and other neonicotinoids act on the central nervous system of insects as an agonist of acetylcholine, the neurotransmitter that stimulates nAChR, targeting the same receptor site (AChR) and activating post-synaptic acetylcholine receptors but not inhibiting AChE. The acute health risks to humans from exposure to clothianidin are minimal due to its low mammalian toxicity. Extrapolation from test results on animals to humans suggests that clothianidin is moderately toxic through oral exposure, but toxicity is low through skin contact or inhalation. Mild to moderate poisoning can cause nausea, vomiting, diarrhea, abdominal pain, dizziness, headache, and mild sedation. While clothianidin may cause slight eye irritation, it is not expected to be a skin sensitizer or irritant.</p> <p>Large deliberate ingestions have caused agitation, seizures, metabolic acidosis, coma, hypothermia, pneumonitis, respiratory failure, hypotension, ventricular dysrhythmias, and death.</p> <p>Rare caustic injury to the esophagus has been reported. This is likely due to the solvent component (N-methyl-2-pyrrolidone) of the insecticide, as opposed to the neonicotinoid itself. Clothianidin does not damage genetic material, nor is there evidence that it causes cancer in rats or mice; it is unlikely to be a human carcinogen. Submitted data also indicate that no significant adverse environmental impacts are expected to occur from the use of clothianidin.</p>	<p>MANAGEMENT OF MILD TO MODERATE TOXICITY</p> <p>Treatment is symptomatic and supportive. Administer IV fluids for hypotension.</p> <p>MANAGEMENT OF SEVERE TOXICITY</p> <p>Treatment is symptomatic and supportive. Treat hypotension with IV fluids; add vasopressors if hypotension persists. Treat dysrhythmias per ACLS guidelines. Consult a gastroenterologist for patients with pain on swallowing; drooling; or other evidence of caustic injury to evaluate for esophageal damage. Atropine should be considered if a patient is bradycardic, or experiencing cholinergic symptoms because these insecticides are frequently mixed with organophosphate and carbamate pesticides.</p>

Summary of Acute Exposure Symptoms and Treatment of WHO-recommended Clothianidin/deltamethrin Combination

Clothianidin/Deltamethrin combination	
Human side effects	Treatment
<p>Local:, Skin and eye paresthesia which may be severe, Usually transient with resolution within 24 hours, Skin, eye and mucous membrane irritation, Cough, Sneezing</p> <p>Systemic:, discomfort in the chest, Tachycardia, Hypotension, Nausea, Abdominal pain, Diarrhea, Vomiting, Blurred vision, Headache, anorexia, Somnolence, Coma, Convulsions, Tremors, Prostration, Airway hyper reaction, Pulmonary oedema, Palpitation, Muscular fasciculation, Apathy, Dizziness</p>	<p>Systemic treatment: Initial treatment: symptomatic. Monitor: respiratory and cardiac functions. In case of ingestion gastric lavage should be considered in cases of significant ingestions only within the first 2 hours. However, the application of activated charcoal and sodium sulphate is always advisable. Keep respiratory tract clear. Oxygen or artificial respiration if needed. In case of convulsions, a benzodiazepine (e.g. diazepam) should be given according to standard regimens. If not effective, phenobarbital may be used.</p> <p>Contraindication: atropine.</p> <p>Contraindication: derivatives of adrenaline. There is no specific antidote. Recovery is spontaneous and without sequelae.</p> <p>In case of skin irritation, application of oils or lotions containing vitamin E may be considered.</p>
Environmental Impacts	
<p>In terrestrial environments, deltamethrin is not expected to be mobile, because it binds tightly to soil particles. It is insoluble in water, and recommended application rates are low. Volatilization from moist soils and biodegradation are major fate processes. However, volatilization is lessened by deltamethrin's tendency to adsorb to soil particles. As with other synthetic pyrethroids, deltamethrin degrades rapidly in soil and plants. It does not bioaccumulate in terrestrial systems. Very little leaching to groundwater is expected, because deltamethrin binds tightly to soil and is practically insoluble in water. Volatilization is a major environmental fate process in surface waters, but is lessened by soil adsorption. Deltamethrin breaks down quickly in water, with reported half-lives of 2–4 hours. It has a high potential to bioconcentrate in aquatic organisms.</p>	

**BUREAU FOR GLOBAL HEALTH
CLIMATE RISK MANAGEMENT SCREENING TEMPLATE
The PMI VectorLink Project**

1. Program/Activity Data

Program/Activity Number	AID-OAA-TO-17-00027
Program/Activity Title	The President’s Malaria Initiative (PMI) VectorLink Project
Country/Region	World Wide
USG Foreign Assistance Framework	PMI 2015-2020 Malaria Strategy
Period Covered	Sept 2017 – Sept 2022
Life of Project Amount	\$472 million
Screening prepared By	Allison Belemvire, Malaria Technical Advisor
Management Unit Contact Person	Kristen George, COR
Current Date	March 4 th , 2020

2. Climate Risk Ratings

This document serves to document the results of the Climate Resiliency Screening conducted to evaluate the potential climate risks of the described activities. In accordance with the [Mandatory Reference for ADS Chapter 201 on Climate Change in USAID Strategies](#), USAID must conduct climate risk management screening for all new projects, and activities, as of October 1st, 2016. ¹⁵

¹⁵ Climate Risk Ratings are defined as:

- Low climate risk: Climate change is unlikely to significantly impact achievement of development outcomes relative to other stressors and development challenges.
- Moderate or high climate risk: Climate change is likely or highly likely to significantly impact achievement of development outcomes.

Background

The President's Malaria Initiative (PMI) VectorLink Project is a five year task order awarded to Abt Associates on September 29, 2017. The purpose of the PMI VectorLink Project is to support PMI in planning and implementing indoor residual spraying (IRS) programs and other proven, life-saving, malaria vector control interventions with the overall goal of reducing the burden of malaria in Africa. The four objectives are as follows: 1) Direct implementation of and/or technical assistance for implementation of IRS and other malaria vector control interventions, 2) Supporting entomological and epidemiological monitoring for strategic decision-making, 3) Procurement of insecticides for IRS and support for the delivery and storage of vector control commodities, and 4) Support for innovation in malaria vector control interventions. The PMI VectorLink project is a follow-on to the PMI AIRS project, and thus, the approved CRM for that project was used as the basis for this document. In addition, the USAID Climate Risk Screening and Management Tools were consulted to assess the project and determine the appropriate risks and best approaches to mitigate those risks. This CRM screening was completed by the COR and project management team responsible for overseeing the PMI VectorLink Project.

For 2020, PMI VectorLink Benin will conduct IRS in six districts (Copargo, Djougou, Ouaké, Gogounou, Kandi and Segbana) in Donga and Alibori from April 6th 2020 to April 30, 2020 and will provide capacity-building support to the national and district governments to plan and implement quality IRS in the future

CLIMATE RISK MANAGEMENT SUMMARY TABLE

The PMI VectorLink Benin

Project Elements	Potential Climate Risk	Climate Risk Rating¹⁶	How Risks are Addressed at the Project Level	Further Analysis or Actions for Activity Design or Implementation	Opportunities to Strengthen Climate Resilience
Indoor residual spraying activities to reduce the morbidity and mortality of malaria	Long-term weather pattern changes can affect vector distribution and affected populations, thus requiring careful analysis and potential shifts in where IRS operations are targeted.	Moderate risk	Monitor vector distribution and malaria outbreaks. Refocus activities based on ento/epi data to ensure appropriate targeting of IRS.	N/A	Expand the collection of context indicators to include climate related data to better connect changes in vector populations with climate variability where feasible.
	Lack of water for mixing insecticide and end of day clean up, due to shifting precipitation patterns.	Moderate risk	Ensure alternative water supplies are available (i.e. budget for water storage tanks, transportation, etc.).	N/A	N/A

¹⁶ Climate Risk Ratings are defined as:

- Low climate risk: Climate change is unlikely to significantly impact achievement of development outcomes relative to other stressors and development challenges.
- Moderate or high climate risk: Climate change is likely or highly likely to significantly impact achievement of development outcomes.

Project Elements	Potential Climate Risk	Climate Risk Rating¹⁶	How Risks are Addressed at the Project Level	Further Analysis or Actions for Activity Design or Implementation	Opportunities to Strengthen Climate Resilience
	Inaccessibility of sites (i.e. roads/bridges wash away) and unavailability of households (i.e. farming fields), due to unpredictable, earlier start of the rainy season start	Moderate risk	Monitor weather patterns. Ensure adaptability of spray calendar (i.e. half day sprays, budget for mop-up days, etc.). Consider alternative transportation (i.e. horse carts, boats).	N/A	N/A
	Severe weather (i.e. drought, floods) impact electricity, cell networks and internet in offices and field sites.	Moderate risk	Ensure alternative energy sources (i.e. generators and solar panels) and maintain an alternate communication plan in case of emergency.	N/A	Explore utilization of solar panels as an energy source which would help to reduce emissions.
	Increased temperatures can impact spray teams' ability to deliver IRS (i.e. heat exhaustion)	Moderate risk	Ensure daily health monitoring checklists are implemented and seasonal workers are aware of signs and risks of heat exhaustion. Further update BMPs to allow for intake of nourishment. Ensure IRS operations occur in the morning through mid-day to avoid increased temperatures to the greatest extent possible.	N/A	
Entomological monitoring to	Inaccessibility to access ento sentinel sites (i.e. roads/bridges wash	Moderate risk	Monitor weather patterns. Consider alternative	N/A	

Project Elements	Potential Climate Risk	Climate Risk Rating¹⁶	How Risks are Addressed at the Project Level	Further Analysis or Actions for Activity Design or Implementation	Opportunities to Strengthen Climate Resilience
monitor malaria activities	away), due to unpredictable weather patterns		transportation (i.e. horse carts, boats).		
	Unavailability of wild caught mosquitoes/larvae due to unpredictable rains (i.e. drought, or flooding of breeding sites) inhibiting the ability to collect necessary quantities of field mosquitoes for entomological testing	Moderate risk	Consider feasibility of using Kisumu strain, laboratory reared mosquitoes.	N/A	
	Severe weather (i.e. drought, floods) impact electricity, cell networks and internet in offices and field sites.	Moderate risk	Ensure alternative energy sources (i.e. generators and solar panels) and maintain an alternate communication plan in case of emergency.	N/A	Explore utilization of solar panels as an energy source which would help to reduce emissions.
Long lasting insecticide treated bednet distribution and monitoring to reduce the malaria burden	Long-term weather pattern changes can affect vector distribution and affected populations.	Moderate risk	Monitor vector distribution and malaria outbreaks. Refocus activities based on ento/epi data to ensure appropriate targeting of bednets.	N/A	

Project Elements	Potential Climate Risk	Climate Risk Rating¹⁶	How Risks are Addressed at the Project Level	Further Analysis or Actions for Activity Design or Implementation	Opportunities to Strengthen Climate Resilience
	Increased temperatures can decrease bednet usage	High risk	Monitor bednet usage and reinforce social behavioral change communication messages.	N/A	
	Inaccessibility of distribution sites (i.e. roads/bridges wash away) due to unpredictable or severe weather	Moderate risk	Monitor weather patterns. Consider alternative transportation and distribution plans.	N/A	

NOTE: Low climate risk does not require the development of specific plans to address climate risk. However, moderate to high climate risk requires appropriate consideration and response to the potential risk. In some cases, the program may decide to accept the risk and will document the justification.

ANNEX D: NAMES AND POSITIONS OF THE STAKEHOLDERS INTERVIEWED

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13	MARIUS HUGGUES DEGLA	CADRE DISE / ABE	95408555
14	BOKO GAUTHE YVETTE	DGEC	97446532
15	ELEGBEDE MAURILLE	DEGEC	95490488
16	BOSSOU BERTIN DOSSE	DGNPPE/DGEC	95054785
17	GONOU SANDRA	DGRACC/DGEC	97372864
18	GANDO HERMIONE	DGNPPE/DGEC	66337547
19	HOUFOUDE FRENOU G.	DGNPPE/DGEC	96668661
20	ADOSOU ERIC	DPV/ MAEP	97037283
21	AKOGBETO MARTIN	CREC	97012545
22	FAFEH PASCAL	SE / PSSP	95813148
23	MOUSSE LATIF	DG DASRI	95960064
24	DOSSOU GBETE LUCIEN	PRESIDENT PSSP	95963832
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