



U.S. PRESIDENT'S MALARIA INITIATIVE



AMENDMENT #2 TO THE ZAMBIA SUPPLEMENTAL ENVIRONMENTAL ASSESSMENT FOR INDOOR RESIDUAL SPRAYING FOR MALARIA CONTROL 2015 - 2020

Recommended Citation: Zambia Supplemental Environmental Assessment: Amendment 2, June 2019. Lusaka. The PMI VectorLink Project, Abt Associates Inc.

Contract and Task Order Number 6: AID-OAA-I-17-00008 & AID-OAA-TO-17-00027

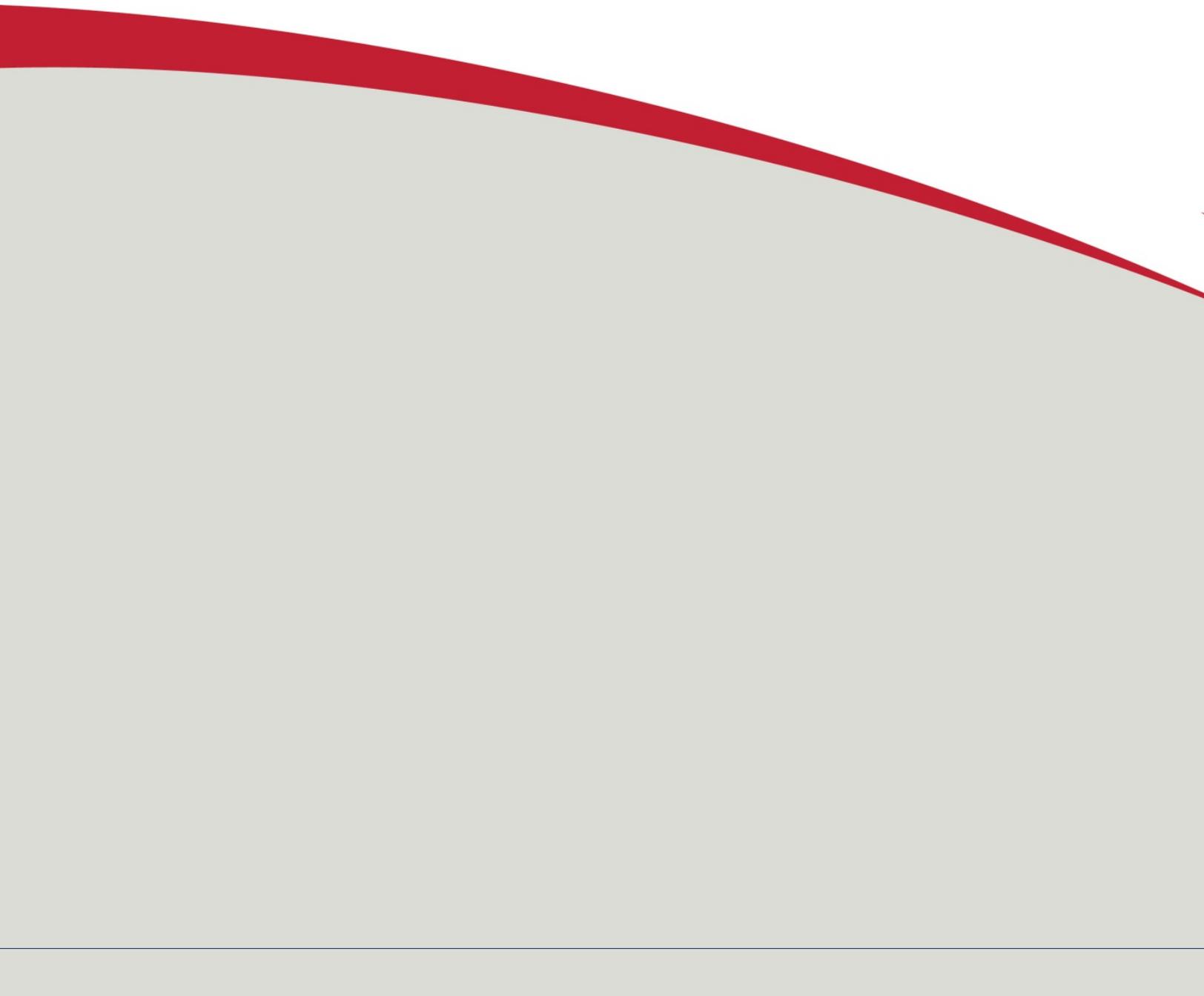
Submitted to: The United States Agency for International Development/President's Malaria Initiative

The views expressed in this document do not necessarily reflect the views of the United States Agency for International Development or the United States Government



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

**AMENDMENT #2 TO THE
ZAMBIA SUPPLEMENTAL
ENVIRONMENTAL ASSESSMENT
FOR INDOOR RESIDUAL
SPRAYING FOR MALARIA
CONTROL 2015 - 2020**



CONTENTS

Executive Summary	vii
Approval	1
1. Background and Purpose	3
1.1 Objectives.....	3
1.1.1 Authorization for the Use of Clothianidin/Deltamethrin Mixtures.....	3
1.1.2 Rotation of Insecticides and the Need for Technical Support for the Use of DDT.....	3
1.2 Area and Scope of IRS for Zambia in 2019	5
1.3 Entomological Monitoring.....	6
2. Proposed Action and Alternatives	7
2.1 Description of Proposed Action	7
2.2 No-Project Alternative.....	7
2.3 Alternative IRS Geographical Sites Considered.....	8
2.4 Use of Alternative Insecticide(s).....	8
3. Pesticide Procedures	9
3.1 The United States Environmental Protection Agency’s Registration Status of the Requested Pesticide.....	9
3.2 Basis for Selection of the Requested Pesticides	9
3.3 Extent to which the Proposed Pesticide Use is Part of an Integrated Pest Management/IVM Program	9
3.4 Proposed Method or Methods of Application, Including Availability of Appropriate Application and Safety Equipment	10
3.5 Acute and Long-term Toxicological Hazards Associated with the Proposed Use and Measures Available to Minimize Such Hazards	10
3.5.1 Human Health Hazards	10
3.6 Effectiveness of DDT, Clothianidin, and Clothianidin/Deltamethrin Mixtures for Proposed Use.....	11
3.7 Compatibility of DDT and Clothianidin/Deltamethrin Mixtures with Target and Non-Target Ecosystems.....	11
3.8 Conditions under which the Pesticide is to be Used.....	11
3.9 Availability and Effectiveness of Other Pesticides or Non-Chemical Control Methods.....	12
3.10 Requesting Country’s Ability to Regulate or Control the Distribution, Storage, Use, and Disposal of the Requested Pesticide.....	12
3.10.1 Pesticide and Toxic Substance Regulation.....	12
3.11 Provisions Made for Training of Spray Operators.....	12
3.12 Provisions Made for Monitoring the Use and Effectiveness of the Pesticide	13

4. Environmental and Health Impacts	15
4.1 Potential Positive Effects of Clothianidin and DDT.....	15
4.1.1 Direct Positive Effects	15
4.1.2 Indirect Positive Effects	15
4.2 Negative Effects – Toxicity of DDT and Clothianidin/Deltamethrin to Avifauna, Aquatic Life, Mammals, and Insects by Class	15
4.2.1 Clothianidin.....	15
4.2.2 Deltamethrin.....	16
4.3 DDT.....	16
4.3.1 Acute Toxicity	16
4.3.2 Chronic Toxicity	17
4.3.3 Reproductive Effects.....	17
4.3.4 Teratogenic Effects.....	17
4.3.5 Mutagenic Effects	17
4.3.6 Carcinogenic Effects	17
4.3.7 Organ Toxicity.....	18
4.3.8 Fate in Humans & Animals.....	18
4.3.9 Effects on Birds	18
4.3.10 Effects on Aquatic Species.....	18
4.3.11 Effects on Other Animals	18
4.3.12 Breakdown in Soil and Groundwater	18
4.3.13 Breakdown of Chemical in Surface Water.....	19
4.3.14 Breakdown of Chemical in Vegetation.....	19
4.3.15 Cumulative Impact	19
5. Safer Use Action Plan.....	21
Annex A: Summary of Acute Exposure Symptoms and Treatment of Clothianidin and Deltamethrin.....	23
Annex B: Environmental Mitigation and Monitoring Plan.....	25
Annex C: Environmental Mitigation and Monitoring Report.....	37
Annex D: Bibliography	43

ACRONYMS

AI	Active Ingredient
AIRS	Africa Indoor Residual Spraying Project
CDC	Centers for Disease Control and Prevention
COR	Contracting Officer's Representative
DDT	Dichlorodiphenyltrichloroethane
ECO	Environmental Compliance Officer
EMA	Environmental Management Agency
EMMP	Environmental Mitigation & Monitoring Plan
EMMR	Environmental Mitigation & Monitoring Report
GRZ	Government of the Republic of Zambia
IARC	International Agency for Research on Cancer
IP	Implementing Partner
IRM	Insecticide resistance management
IRS	Indoor Residual Spraying
IVM	Integrated Vector Management
LLIN	Long-lasting insecticide-treated nets
MOH	Ministry of Health
NMEP	National Malaria Elimination Program
PEA	Programmatic Environmental Assessment
PMI	President's Malaria Initiative
POP	Persistent Organic Pollutant
PPE	Personal protective equipment
PQ	World Health Organization Prequalification Team
RfD	Reference Dosage
SUAP	Safer Use Action Plan
SEA	Supplemental Environmental Assessment
SOP	Spray Operator
TAC	Technical Advisory Committee
USAID	United States Agency for International Development
WHO	World Health Organization
WHO PQ	World Health Organization Pre-Qualification

EXECUTIVE SUMMARY

This document has been prepared to serve as a second amendment to the 2015-2020 Supplemental Environmental Assessment (SEA) for Indoor Residual Spraying (IRS) in Zambia. The current SEA authorized the use of the pyrethroid, carbamate, organochlorine, and organophosphate classes of insecticides recommended by the World Health Organization for IRS in Zambia, as well as chlorfenapyr, in the pyrrole class, when listed by the World Health Organization (WHO) Prequalification Team (PQ). The first amendment authorized the use of clothianidin, a neo-nicotinoid, for IRS.

This amendment to the SEA seeks nationwide authorization for the provision of technical assistance (TA) to the National Malaria Elimination Program (NMEP) of the Government of the Republic of Zambia (GRZ) regarding the use of dichlorodiphenyltrichloroethane (DDT) for IRS, focusing in three provinces that were previously sprayed with organophosphate by the PMI VectorLink (VL) Project. It also seeks authorization for the use of clothianidin/deltamethrin formulations which was WHO PQ listed in December 2018. This amendment also serves as the 2019 Letter Report for Zambia

Zambia has been implementing IRS for malaria control as part of an integrated vector management (IVM) strategy consistently since 2003. In 2019, PMI proposes to spray 17 high-burden malaria districts of Eastern and Copperbelt Provinces and Nchelenge in Luapula Province; including three pre-elimination districts in Eastern Province. PMI will use a long-lasting insecticide in the neonicotinoid class, clothianidin, in nine districts and a clothianidin/deltamethrin formulation in 11 districts previously sprayed with Actellic 300 CS.

DDT is unique among other IRS insecticides in that it is a persistent organic pollutant (POP). As stated by the Stockholm Convention, POPs such as DDT “possess toxic properties, resist degradation, bioaccumulate, and are transported, through air, water, and migratory species across international boundaries and deposited far from their place of release, where they accumulate in terrestrial and aquatic ecosystems.” Because of these characteristics, PMI requires an annual update of the original SEA for the use of DDT, or the provision of technical assistance for the use of DDT. This amendment to the SEA constitutes that update for 2019-2020.

To manage vector insecticide resistance to IRS, new viable insecticides must be introduced for use. Clothianidin was listed by WHO PQ as a recommended insecticide for IRS, and is therefore approved for use by the 2017 SEA amendment. Furthermore, the clothianidin/deltamethrin formulation was PQ-listed in 2018 and can be used for IRS. For clothianidin/deltamethrin mixtures to be added as an IRS alternative, the United States Agency for International Development (USAID) and PMI must approve this amendment to the existing SEA. This SEA amendment is therefore seeking authorization for the use of clothianidin/deltamethrin formulations in any area of the country during the validity of the parent SEA, in anticipation of future needs.

Therefore, the proposed actions analyzed in this document are:

- Continue IRS programming for 2015-2020, implementing a rotational or mosaic technique, using pyrethroids, carbamates, organophosphates, , clothianidin, or clothianidin/deltamethrin combination or chlorfenapyr (when PQ-listed) where appropriate, based on pesticide resistance patterns throughout the country and other critical factors.
- Provide technical assistance to the Zambian NMEP for the management of DDT insecticide, including transportation, storage, and waste management.

All conditions of the existing 2015 SEA, including the Safer Use Action Plan (SUAP), will remain valid, and all PMI IRS operations in Zambia will adhere to the protocols and procedures found therein. This amendment contains a revised Environmental Mitigation and Monitoring Plan (EMMP), Annex B, which reflects the increased potential scope of PMI VectorLink activities.

The Implementing Partner will share the approved final document with the host country government and with the Southern African Pesticides Regulators Forum.

APPROVAL

APPROVAL OF ENVIRONMENTAL ACTION RECOMMENDED AMENDMENT OF THE 2015-2020 SUPPLEMENTAL ENVIRONMENTAL ASSESSMENT FOR THE U.S. PRESIDENT’S MALARIA INITIATIVE INDOOR RESIDUAL SPRAYING FOR MALARIA CONTROL IN ZAMBIA

The USAID Global Health Bureau has determined that the proposed indoor residual spraying effort, as described here in Amendment #2 to the 2015 - 2020 SEA, responds to the needs of the community and country as it relates to managing malaria in Zambia, and also conforms to the requirements established in Title 22 Code of Federal Regulations 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 IRS program’s design and standards of operation are intended to reduce, and if possible, avoid, any potential adverse impact on individuals or the environment. USAID has concluded that the proposed action, when executed as described in the SEA and in the Programmatic Environmental Assessment for PMI IVM (2012 and 2017), is consistent with the Government of the Republic of Zambia’s and USAID’s goal of reducing malaria incidence in Zambia while minimizing negative impacts to the environment and to human health.

The actions recommended for approval in this 2018 SEA amendment are:

- To continue IRS programming for 2015 – 2020 using a rotational or mosaic technique, involving pyrethroids, carbamates, organophosphates, clothianidin, and clothianidin/deltamethrin formulations or chlorfenapyr (when it is listed by WHO pre-qualification), where appropriate, based on pesticide resistance patterns throughout the country and other critical factors.
- To provide technical assistance to the Government of the Republic of Zambia for the environmentally compliant use of DDT for IRS.

The SUAP in the 2015-2020 SEA and the PMI best management practice (BMP) manual provide detailed guidance on the performance of all activities associated with IRS.

CLEARANCE:

USAID/Zambia Mission Director:

Date: *Dennis W. Durbin* 7/19/19

CONCURRENCE:

GHI/Bureau Environmental Officer:

Dennis W Durbin (affiliate) Digitally signed by Dennis W Durbin (affiliate) Date: 2019.08.05 15:58:52 -04'00' Date: _____

ADDITIONAL CLEARANCES:

AFR/Bureau Environmental Officer:

[Signature] Date: 8/12/19

USAID/Zambia Mission Acting Health Office Director:

[Signature] Date: 7/12/19

PMI Resident Advisor:

[Signature] Date: 7/10/19

USAID/Zambia Mission Environmental Officer:

[Signature] Date: 08/03/2019

USAID/Southern Africa, South Africa Regional Environmental Advisor:

Email clearance Date: 06/27/2019

I. BACKGROUND AND PURPOSE

I.1 OBJECTIVES

PMI's IRS activities in Zambia operate under a Supplemental Environmental Assessment (SEA), which was approved in September 2015. The SEA was prepared in accordance with the provisions of Title 22 Code of Federal Regulations (216) regarding the use and application of pesticides. It is nationwide in scope, and authorizes the use of five classes of WHO-recommended pesticides: pyrethroid, carbamate, organochlorine, organophosphate, neonicotinoid, as well as chlorfenapyr (when WHO PQ-listed). The first amendment to the SEA authorized the use of clothianidin. This document has been prepared to serve as a second amendment to that SEA, and proposes to authorize the use of clothianidin/deltamethrin mixtures for IRS in all areas of Zambia. In addition, PMI intends to provide technical support to the NMEP as it transitions to DDT for vector control in Northern, Luapula, and Muchinga provinces. This amendment is intended to fulfill the requirement for an annual update to any SEA authorizing DDT use that outlines the reasons for the continued use of this regulated insecticide, in accordance with the requirements of the Stockholm Convention. Finally, this amendment will also serve as the annual Letter Report that is required for PMI IRS campaigns.

This SEA amendment outlines the rationale for the continued availability of DDT for vector control in Zambia, as well as the safeguards that will be employed to prevent environmental contamination or damage to human health. It also describes the characteristics, benefits, and potential hazards of DDT and clothianidin mixtures with deltamethrin, as well as the legal and regulatory status of these active ingredients in Zambia and in the United States.

I.1.1 AUTHORIZATION FOR THE USE OF CLOTHIANIDIN/DELTAMETHRIN MIXTURES

In order to expand the insecticide options for IRS to manage vector insecticide resistance in Zambia, new viable insecticides must be introduced for use. Changing insecticides classes over time and space is a leading way to manage resistance, and having more alternatives available increases the chances of mitigating resistance. For these reasons, PMI Zambia and the Ministry of Health are seeking authorization to spray with formulations of clothianidin/deltamethrin nationwide. Clothianidin and deltamethrin are fully registered by Zambia Environmental Management Agency (ZEMA) the competent authority for approval of insecticide in Zambia.

I.1.2 ROTATION OF INSECTICIDES AND THE NEED FOR TECHNICAL SUPPORT FOR THE USE OF DDT

The NMEP has been working with the national Insecticide Resistance Technical Advisory Committee (TAC) to make decisions on various vector control issues. Globally, there has been increased threat of insecticide resistance, which has called for the need to establish an Insecticide Resistance Management Technical Working Group (IRMTWG) to make important strategic decisions key to insecticide resistance management (IRM) in the country. The TAC is a special group of individuals brought together to work on a specific task for a defined period of time. In this case, the group has been appointed to make decisions related to IRM in the country.

In rotational strategies, two or preferably more insecticide classes with different modes of action are rotated over time. This approach assumes that if resistance to each insecticide is rare then multiple resistances will be extremely rare. It allows for any resistance developed to the first insecticide to decline over time when the second insecticide class is introduced. The timeframe for rotation needs to be sufficiently short to prevent

significant levels of resistance to develop to any one rotation partner, and should be guided by the insecticide resistance profile data collected annually from the entomological sentinel sites.

The NMEP will use the rotation method as priority in the management of insecticide resistance. In this case, insecticides with different modes of action will be rotated. This rotational approach shall further be guided by the results of insecticide susceptibility tests.

In Northern, Luapula and Muchinga province, PMI has been supporting implementation of IRS using Actellic 300CS for five years. The NMEP decided to rotate from pirimiphos-methyl to DDT in fifty-six districts in 2019. The NMEP took into account multiple factors when deciding on DDT target districts. The TAC findings and recommendations on insecticide resistance were among these factors. For example, areas with prominent agriculture export crops were excluded from DDT, and some areas where DDT was recommended as a second choice by the TAC were mapped for DDT due to the SADC policy of increasing utilization of DDT.

Given PMI's practical preference to continue supporting deployment of a non-DDT insecticide, the NMEP has advised that PMI transition out of implementing IRS in three provinces, and support other high-prevalence areas, specifically Copperbelt and Eastern provinces and Nchelenge district in Luapula Province.

Therefore, in 2019, VectorLink Zambia will use clothianidin and clothianidin/deltamethrin combination insecticides in the PMI spray districts. However, the project will continue to provide technical assistance and work with provincial and district health officials in the three provinces namely Northern, Luapula, and Muchinga, to allow for a phased withdrawal from these provinces and a smooth transition to DDT. Included in this technical assistance will be dissemination of best practices for the management of DDT, including waste management. Specific technical assistance will include the following:

1. Pre-season Environmental Compliance Inspection
 - Visit selected operations sites and assess their readiness to conduct environmentally-compliant IRS using DDT.
2. IRS liquid waste management
 - Provide technical assistance in the procurement of materials for construction of DDT mobile soak pits and related receptacles.
 - Provide technical support on how to use DDT mobile soak pits in management of DDT liquid waste, and conduct field demonstrations at training of trainers (TOT).
3. Trainings on DDT use
 - Conduct trainings to drivers, storekeepers, and guards on safe handling during transportation and storage of DDT.
 - Train supervisors on DDT handling and application during training of trainers (TOT).
4. Safe storage of insecticides
 - Advise the province on safe storage of DDT.
 - Identify temporary DDT storage facilities which are compliant to BMP requirements.
 - Inspect storerooms for compliance with the BMPs.

5. Environmental compliance monitoring
 - Ensure that team leaders perform daily health checks.
 - Ensure that paper checklists are available for use by supervisors for environmental compliance monitoring in the field.
 - Conduct end-of-day clean up inspection and advise proper use of mobile soak pits.
6. Post IRS environmental Assessments
 - Assist the districts to conduct the post-IRS environmental assessment.

I.2 AREA AND SCOPE OF IRS FOR ZAMBIA IN 2019

In 2019, once this SEA amendment is approved, PMI will spray 617,000 structures broken down as follows: Nchelenge (38,000), Copperbelt Province (153,016), six new districts of Eastern Province (308,540), and three pre-elimination districts of Eastern Province (117,444). The estimated number of people to be protected by IRS is 2,505,747.

The 2019 VectorLink Zambia spray campaign will run for 30 operational days from October 2 to November 7, 2019. The earlier start date compared to the November start date in 2018 is due to data from other PMI countries indicating clothianidin has a longer residual efficacy of about eight months and is therefore expected to be able to cover the transmission season which extends up to March/April. The previous insecticide (Actellic 300CS) had residual efficacy of about four months and therefore the spray campaign had to commence as close to the rainy season as possible to maximize the short residual efficacy.

With PMI's guidance and in collaboration with the GRZ and provincial and district health offices, VectorLink Zambia will strive to achieve the following objectives:

- Cover a minimum of 85 percent of structures found in each targeted community, by implementing high-quality IRS operations.
- Use mapping technology (mSpray) to enhance implementation of the IRS campaign in six targeted districts – Katete, Sinda, Chadiza, Nchelenge, and rural/peri-urban areas of Kitwe and Ndola
- Build capacity at the national, provincial, district, and community levels to manage IRS operations, including planning, spraying, supervision, and monitoring and evaluation.
- Conduct entomological monitoring activities in seven surveillance districts to assess the impact of IRS operations on standard PMI entomological indicators. Generated data will guide insecticide selection for IRS in the future, assess the quality of spraying, and determine the residual life of different insecticides.
- Provide technical assistance to the 2019 GRZ-funded IRS campaign which will conduct IRS using DDT. The three 2018 PMI-supported provinces of Muchinga, Northern and Luapula will be prioritized.
- Establish two provincial satellite offices to decentralize IRS planning activities to the districts and provide direct technical assistance to the districts
- Assist NMEP to re-engage the private sector through public-private partnerships especially in the Copperbelt.
- Provide technical assistance to NMEP through data review in supporting vector control decision-making under integrated data analytics and visualization activity.

I.3 ENTOMOLOGICAL MONITORING

The following entomological activities will be conducted during 2019:

- Entomological surveillance at 14 sentinel sites in seven districts in four provinces of Eastern, Copperbelt, Luapula and Central, to determine vector species composition, abundance, seasonality, biting behavior, sporozoite infection rates, entomological inoculation rate, parity rate and insecticide resistance status.
- Assessment of spray quality in seven PMI-supported IRS districts in three provinces: Eastern, Copperbelt and Luapula.
- Longitudinal monitoring of the insecticide residual efficacy in five PMI-supported IRS districts in three provinces, Eastern, Copperbelt, and Luapula.
- Laboratory analysis of mosquito samples to determine sub-species, blood meal source, and malaria infectivity.

2. PROPOSED ACTION AND ALTERNATIVES

This section describes the alternatives to DDT and formulations with clothianidin/deltamethrin that were considered in the preparation of this report, including those that were accepted or rejected.

2.1 DESCRIPTION OF PROPOSED ACTION

The proposed action is to provide technical assistance to the NMEP as they transition from using Actellic 300CS to use of DDT, and to authorize the use of clothianidin/deltamethrin formulations nationwide in Zambia for IRS. When used for IRS, spray operators apply small amounts of DDT on the inside walls of houses and in some cases under the eaves of houses. Because of its long-lasting action – up to one year – DDT vastly improves malaria control over the use of shorter acting insecticides. DDT works in three ways: it is acutely toxic to mosquitoes and therefore very effective at killing them; it repels mosquitoes so that they do not enter a dwelling in the first place; and it acts as an irritant which may cause mosquitoes to exit a dwelling without biting.

Clothianidin/deltamethrin are WHO PQ listed and registered in Zambia. If authorized by this amendment for use in Zambia, it will provide an additional option for implementing IRS in selected communities while balancing current entomological, epidemiological, logistical, environmental, and economic priorities. The pesticide to be used in an IRS season will be determined by a process fully explained in the 2015 SEA under Pesticide Procedures Part B. (Section 4.2 p. 19).

2.2 NO-PROJECT ALTERNATIVE

PMI has developed best management practices for IRS that have significantly improved the effectiveness, as well as the safety and environmental compatibility of this intervention. Many of these best practices have been adopted by the Zambian government, particularly those pertaining to environmental compliance. In regard to DDT, PMI developed best management practices for handling and management of DDT in Ethiopia and successfully collected, repackaged and shipped for destruction over 100 tons of DDT from 47 storehouses. Key to the environmental compliance of that project was the use of mobile soak pits for the capture and disposal of DDT-contaminated liquid waste water. In addition, PMI through VectorLink provided technical assistance to Zimbabwe in the management of DDT during a transition to DDT similar to what Zambia is planning for 2019. Therefore, the NMEP in Zambia has requested assistance with piloting this technology, as well as guidance on training and implementation of PMI best practices for DDT storage and waste management. The no-project alternative, that is, failure to provide this technical assistance, could result in increased risk of health and environmental impacts from the use of DDT.

Insecticide resistance is one of the most serious threats to malaria control, and resistance management is a key component of IVM. Changing or rotating insecticides in IRS operations is one of the critical strategies in the management of vector resistance to insecticides. A no project alternative will reduce the available alternatives, and possibly result in increasing resistance to the available insecticides. A consequence of that could be rising rates of infections, transmission, mortality, and morbidity due to the increased prevalence of resistant and infected vectors. Therefore, the “no action” alternative does not meet the overall goals of USAID/PMI, or the Zambia NMEP.

2.3 ALTERNATIVE IRS GEOGRAPHICAL SITES CONSIDERED

All regions and districts in Zambia are eligible for PMI support for IRS according to the 2015 SEA. This amendment seeks to maintain nationwide coverage and add clothianidin/deltamethrin formulations as IRS options. The choice of spray sites is made by the NMEP and PMI based on epidemiological, entomological, and other data. Use of different criteria to choose spray sites could reduce the effectiveness of the intervention.

2.4 USE OF ALTERNATIVE INSECTICIDE(S)

Only pesticides recommended by WHO may be selected for use in PMI-supported IRS districts. PMI Zambia and the Zambia NMEP regularly conduct entomological testing to help determine the best choice of WHO-recommended insecticide for use. This amendment proposes to add clothianidin/deltamethrin as an alternative insecticide.

3. PESTICIDE PROCEDURES

Title 22 of the United States Code of Federal Regulations 216 mandates the consideration of 12 factors when a project includes “assistance for the procurement or use, or both, of pesticides.” The existing SEA addresses the 12 factors for the IRS Malaria Control Program in Zambia; this section of the amendment addresses any DDT and clothianidin-specific aspects of those factors.

3.1 THE UNITED STATES ENVIRONMENTAL PROTECTION AGENCY’S REGISTRATION STATUS OF THE REQUESTED PESTICIDE

Clothianidin/deltamethrin are currently registered with United States Environmental Protection Agency (USEPA). Clothianidin was registered with USEPA in 2003. DDT is banned in the United States, but it is recommended for use in public health by WHO in compliance with the requirements of the Stockholm Convention.

3.2 BASIS FOR SELECTION OF THE REQUESTED PESTICIDES

Recommended by WHO: DDT was previously WHOPES approved but currently does not have a WHO PQ listing. Clothianidin/deltamethrin combination is WHO PQ listed.

Registration for use in Zambia: DDT and clothianidin/deltamethrin combinations are registered for IRS use in Zambia. PMI will spray with clothianidin/deltamethrin combinations only upon approval of this SEA amendment.

Residual effect for a period longer than, or at least equal to, the average duration of the malaria transmission season in the area: DDT has the longest duration of effectiveness of all WHO-recommended insecticides. The duration of effectiveness of clothianidin/deltamethrin formulations to be used on the primary wall surface types is reported to be greater than or equal to the duration of the transmission season (about eight months), but these properties will be investigated further in upcoming operations if this amendment is approved.

Ecological Impact: If PMI BMPs for IRS are strictly followed, the release to the environment, and therefore the impact to the environment, should be negligible. Refer to 2017 Programmatic Environmental Assessments (PEA) for IVM for further information.

Human Health Impact: The 2017 IVM PEAs also assessed cancer and non-cancer risks associated with DDT and clothianidin/deltamethrin mixtures by process (e.g., mixing insecticide, spraying, residing in sprayed house) and pathway (e.g., inhalation, dermal, ingestion, etc.). Based on the risk screening results, adverse human health effects for workers or residents are not expected from the use of DDT or clothianidin mixtures with deltamethrin. More information on the potential human health impact of DDT and clothianidin/deltamethrin mixtures is found in the 2012 and 2017 PEAs.

3.3 EXTENT TO WHICH THE PROPOSED PESTICIDE USE IS PART OF AN INTEGRATED PEST MANAGEMENT/IVM PROGRAM

IVM for the control of the malaria vector population is practiced using two primary interventions— Insecticide-treated nets and indoor residual spraying. Environmental management for malaria control is limited to some common-sense safeguards, such as eliminating standing water, which can serve as a breeding ground for mosquitoes. PMI does not support environmental management as a vector control method, because the life-cycle requirements and the adaptability shown by malaria vectors limit the large-scale

effectiveness of these measures. PMI strategy has been that IRS will be implemented as a component of IVM for malaria control.

3.4 PROPOSED METHOD OR METHODS OF APPLICATION, INCLUDING AVAILABILITY OF APPROPRIATE APPLICATION AND SAFETY EQUIPMENT

DDT and clothianidin/deltamethrin mixtures will be applied using the same compression spray equipment and techniques as other WHO-recommended insecticides and the same cautions apply. The SUAP in Chapter 6 of the 2015 SEA and the PMI IRS BMP Manual (USAID 2015) must be consulted and followed.

3.5 ACUTE AND LONG-TERM TOXICOLOGICAL HAZARDS ASSOCIATED WITH THE PROPOSED USE AND MEASURES AVAILABLE TO MINIMIZE SUCH HAZARDS

The 2012 and 2017 IVM PEAs assessed the toxicity of DDT and clothianidin/deltamethrin mixtures to non-target organisms, including mammals, birds, fish, bees, and other aquatic organisms. Submitted data indicate that no significant adverse environmental impacts are expected to occur from the use of these active ingredients.¹ Refer to the PEA for greater detail about their toxicity.

3.5.1 HUMAN HEALTH HAZARDS

Clothianidin: The risk results for clothianidin are based on a two-generation reproduction study on rats, in which the rats were exposed through normal feeding; endpoints included weight gain, sexual maturation, and stillbirths. The health benchmark derived from this study and recommended by the USEPA is: 0.0098 mg/kg/day, this is the calculated human exposure toxicity level with the 100x risk factor included (USEPA 2012). This value was calculated using an uncertainty factor of 100 to account for differences in intra-species sensitivity (10), and the lack of human exposure studies (10). In addition, a modifying factor of 10 was also applied to capture uncertainty associated with the lack of a developmental immune-toxicity study (a requirement under USEPA pesticide registration guidelines). The application of the same health benchmark across all exposure durations and exposure routes provides a conservative representation of toxicity, as absorption is typically higher for oral administration than for dermal contact, and the physiological response to shorter exposures allows recovery (in contrast with chronic exposures). Based on the risk screening results and the inherently conservative nature of the calculation, adverse human health effects for workers or residents are not expected from the use of clothianidin.² 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.³

Deltamethrin: The risk results for the clothianidin/deltamethrin combination are based on the same study on clothianidin and, for deltamethrin, an acute study on neurological effects in rats (used for oral and inhalation), and an acute dermal contact study on rats that observed local effects on the skin. The USEPA determined that there was no apparent increase in hazard with repeated or chronic exposures, so the benchmarks derived from the acute studies were used directly as benchmarks for intermediate and chronic exposures (USEPA 2004). All derived Reference Dosages (RfDs) were based on a UF of 100 that represented differences in intra-species sensitivity (10), and the lack of human exposure studies (10). Based on the risk screening results, adverse health effects for workers or residents are not expected.

DDT: The short-term acute effects of DDT on humans are limited, but long-term exposures have been associated with chronic health effects. DDT has been detected in breast milk, raising serious concerns about infant health. Due to these potential impacts, when using DDT for IRS activities, all best management

¹ <http://www.cdpr.ca.gov/docs/registration/ais/publicreports/5792.pdf> Accessed 7/14/17

² IVM PEA, 2017. Integrated vector management programs for malaria vector control (version 2017). USAID

³ <https://toxnet.nlm.nih.gov/cgi-bin/sis/search/a?dbs+hsdb:@term+@DOCNO+7281>, accessed 7/14/17

practices (see the 2015 PMI IRS BMP manual) must be strictly adhered to, to ensure DDT is contained and that females employed by this project do not have any contact with the pesticide. See section 4.1.2 of this amendment for more information on the health and environmental impacts of these insecticides.

3.6 EFFECTIVENESS OF DDT, CLOTHIANIDIN, AND CLOTHIANIDIN/DELTAMETHRIN MIXTURES FOR PROPOSED USE

To determine the quality of spray and residual performance of DDT and clothianidin/deltamethrin mixtures on walls, cone bioassays will be conducted within two weeks of IRS, and this will be continued monthly. Bioassays will be conducted using the WHO cone bioassay method in three structures with mud walls and three with walls made of cement. Cone bioassays will be performed according to WHO standard protocols, with one cone each at 0.5, 1.0, and 1.5m height. Cone bioassays will continue monthly until vector mortality is below 80% for two consecutive months, based on the five-day holding period for clothianidin and clothianidin/deltamethrin insecticides.

Abbott's correction will be implemented if mortality is between 5% and 20% in the negative controls after five days. If mortality is >20% after 5 days in untreated controls, tests will be repeated.

PMI will monitor changes in mosquito populations at:

- Three sites sprayed with clothianidin/deltamethrin mixture
- Two sites sprayed with clothianidin
- Two sites sprayed with DDT
- One unsprayed site in each of the seven sprayed districts.

3.7 COMPATIBILITY OF DDT AND CLOTHIANIDIN/DELTAMETHRIN MIXTURES WITH TARGET AND NON-TARGET ECOSYSTEMS

DDT and clothianidin/deltamethrin formulations are compatible with indoor use, which is the target ecosystem (walls, ceilings, eaves of homes). When applied properly, DDT and clothianidin/deltamethrin combination dry on the indoor surfaces and are not released to receptors or the general environment to any great extent. The dried pesticide remains on the sprayed surfaces and performs as designed, killing vector mosquitoes that rest on them, and the exposure to non-target organisms and ecosystems is very limited.

DDT and clothianidin/deltamethrin combination are incompatible with non-target ecosystems (humans, animals, and the environment). If misapplied and released to the environment in large quantities, DDT and clothianidin/deltamethrin combination could have negative effects on land- and water-based flora and fauna. The IRS implementation process is designed to ensure that, to the maximum extent possible, pesticides are deliberately and carefully applied to the walls and ceilings of dwellings (target ecosystems), and do not come in contact with humans, animals, or the environment. IRS implementation is also planned to minimize and responsibly manage insecticide-contaminated liquids through the reuse of leftover pesticides and contaminated water, the triple rinsing of equipment, the daily washing of personal protective equipment (PPE) and, at a minimum, faces and hands of spray team members. Liquid and solid contaminated wastes are managed in accordance with PMI best management practices. Zambia will be pilot-testing the mobile soak pit for the removal of DDT from liquid waste water.

3.8 CONDITIONS UNDER WHICH THE PESTICIDE IS TO BE USED

Chapter 3 of the 2015 SEA provides a detailed account of the environmental conditions in Zambia under which DDT or the clothianidin/deltamethrin formulations are to be used. During IRS operations, particular attention is paid to any sensitive areas identified in the environmental assessment, including water bodies, schools, hospitals, and any area where organic farming is practiced or where bee-keeping or natural bee

habitats are established. Bird-nesting and bee habitat will be protected, and insecticides will not be stored near water habitats and resources. IRS will be prohibited within 30 meters of all sensitive ecosystems.

3.9 AVAILABILITY AND EFFECTIVENESS OF OTHER PESTICIDES OR NON-CHEMICAL CONTROL METHODS

Only WHO-recommended pesticides may be used for PMI-supported IRS. Other non-chemical control methods are covered under the 2015 SEA recommendations for IVM.

Insecticide resistance in mosquitoes in a targeted IRS area tends to develop after a number of years of continued use of a single insecticide. (DDT is an exception, and only as it relates to malaria vectors in southern Africa, for unknown reasons.) To prevent or minimize this problem, other insecticides beside those that are currently approved by the 2015 SEA need to be available for use in Zambia. This second amendment to the 2015 SEA is seeking authorization to use clothianidin/deltamethrin combinations as alternative insecticide options.

PMI has determined that IRS is a valuable tool in the fight against malaria. If non-chemical control methods are found that can improve or replace IRS, PMI will take appropriate action.

3.10 REQUESTING COUNTRY'S ABILITY TO REGULATE OR CONTROL THE DISTRIBUTION, STORAGE, USE, AND DISPOSAL OF THE REQUESTED PESTICIDE

3.10.1 PESTICIDE AND TOXIC SUBSTANCE REGULATION

Zambia insecticide and toxic substance regulations provide the guidelines and measures for management of insecticides, including storage, transport, usage, and disposal. ZEMA provides the regulation on the use of pesticides for agriculture, horticulture, forestry, gardening and public health and other uses, as well as monitoring the use of pesticides and taking enforcement action against illegal use. It also provides permitting of chemical imports and exports as well as Pesticides Registration & Licensing. All the pesticides proposed for use must be registered for use under the Act, and importation licenses obtained. Clothianidin/deltamethrin formulations is registered and authorized for use in IRS by ZEMA.

3.11 PROVISIONS MADE FOR TRAINING OF SPRAY OPERATORS

The effectiveness of the IRS program depends on the availability of adequately trained spraying personnel, well-maintained equipment, and competent supervision, as well as end-user acceptability and compliance. PMI has developed guidelines for IRS operations (“Best Management Practices (BMP) for Indoor Residual Spraying in Vector Control Interventions”, updated 2015), and provides a training manual “Spray Operator Pocket Guide” (A. Were, (2014, updated 2018) A summary of the training provided to spray operators and other actors is provided in Chapter 6 of the 2015 SEA.

The implementing partner will continue to provide technical support for environmental compliance, with a medium-term goal of building national capacity to progressively transfer responsibilities. Preparations will include a training of trainers program, in which potential supervisors, storekeepers, and team leaders are trained on all aspects of IRS operation. Areas of training shall include planning of IRS, household preparations, record keeping, community mobilization, rational/judicious use of insecticides including sprayer and PPE cleaning, personnel management, environmental aspects of IRS – including geographical reconnaissance, and data recording and analysis.

3.12 PROVISIONS MADE FOR MONITORING THE USE AND EFFECTIVENESS OF THE PESTICIDE

Entomological monitoring is firmly established as a part of PMI and is used for IVM decision-making. The standard practices for entomological monitoring in the project are presented in the approved 2015 SEA and in section 3.6 of this amendment. In the case of the three provinces where we are providing technical assistance to the NMEP, they will be responsible for entomological monitoring that will confirm the effectiveness of the DDT that will be used.

4. ENVIRONMENTAL AND HEALTH IMPACTS

4.1 POTENTIAL POSITIVE EFFECTS OF CLOTHIANIDIN AND DDT

4.1.1 DIRECT POSITIVE EFFECTS

The overall benefits of DDT and clothianidin/deltamethrin combination use in IRS is improved human health and the reduced incidence of mosquito-borne illnesses. Other direct positive impacts of approving the provision of technical assistance for DDT, and the use of clothianidin/deltamethrin mixtures in IRS will include improved capacity for insecticide resistance management, as clothianidin/deltamethrin in combination will serve as an additional option for rotation of insecticides to prevent resistance. Additional positive direct impacts of DDT and clothianidin/deltamethrin mixtures in IRS derive from the expected economic and environmental benefits provided by IRS. (Refer to Section 5.1 p. 32 in the 2015 SEA.)

4.1.2 INDIRECT POSITIVE EFFECTS

The indirect positive impacts of using clothianidin/deltamethrin combinations in IRS are the same as the positive impacts of using the four WHO PQ-listed classes of pesticides. (Refer to section 5.1.2 p. 32 of the 2015 SEA for more detail.)

4.2 NEGATIVE EFFECTS – TOXICITY OF DDT AND CLOTHIANIDIN/DELTAMETHRIN TO AVIFAUNA, AQUATIC LIFE, MAMMALS, AND INSECTS BY CLASS

4.2.1 CLOTHIANIDIN

Important clothianidin characteristics are listed below.

- Acute oral LD50 (lethal dose to 50% of the population): 3900 mg/kg body weight for male rats and 4700 mg/kg for female rats.
- Skin and eye: for rabbits, slight (barely perceptible) transient skin irritation; and it is an eye irritant.
- Inhalation LC50 (lethal concentration to 50% of the population) (4h): for male and female rats >2.3mg/L.
- Other: Not mutagenic. Not oncogenic in rats and mice. Not teratogenic in rats and rabbits.⁴

The acute health risks to humans from exposure to clothianidin are minimal due to its low mammalian toxicity in the context of IRS. Extrapolation to humans from test results on animals suggests that clothianidin is moderately toxic through oral exposure, but toxicity is low through skin contact or inhalation. Potential beneficiary exposure will principally be via skin contact with treated walls, so the product should not pose any significant risk to residents. While clothianidin may cause moderate eye irritation, it is not a skin sensitizer. 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. Mild to moderate poisoning can cause nausea, vomiting, diarrhea,

⁴ United States EPA assessment report (2003)

abdominal pain, dizziness, headache, and mild sedation. Due to reports of unfortunate attempts of human suicides, accounts have indicated that large, deliberate ingestions have caused agitation, seizures, metabolic acidosis, coma, hypothermia, pneumonitis, respiratory failure, hypotension, ventricular dysrhythmias, and death. 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. Overall, when used properly, the product does not pose significant risks to residents.

4.2.2 DELTAMETHRIN

For deltamethrin, the corresponding characteristics are:

- Acute oral LD50 in rats is 9.36 mg/kg
- Inhalation LC50 (2 hours): for rats is 785 mg/L
- Dermal LD50: LD50 in rabbits is 2,000 mg/kg

Deltamethrin is of moderate toxicity to mammals as it is rapidly metabolized and does not accumulate. Deltamethrin exhibits its toxic effects by affecting the way the nerves and brain normally function by interfering with the sodium channels of nerve cells. 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, and fatigue. Tremors and convulsions have been reported in severe poisonings. Dermal exposure to 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. Chronic occupational exposure to deltamethrin has resulted in skin and eye irritation. Long-term animal studies have not shown reproductive or mutagenic effects. International Agency for Research on Cancer (IARC) has classified deltamethrin as “not classifiable as to its carcinogenicity in humans.”

4.2.2.1 AQUATIC LIFE

United States EPA factsheet for clothianidin (2003) states that the chemical should not present a direct acute or chronic risk to freshwater and estuarine/marine fish, or a risk to terrestrial or aquatic vascular and nonvascular plants. Clothianidin may be toxic to aquatic invertebrates if disposal of wastes is not in accordance with BMPs. Clothianidin will not be stored within 30 meters of water bodies, and any transport over water will be according to PMI BMPs.

4.2.2.2 BIRDS

According to the USEPA, clothianidin and clothianidin/deltamethrin combinations are practically non-toxic to selected test bird species that were fed relatively large doses of the chemical on an acute basis.

4.2.2.3 BEES

Bee keeping in Zambia is mainly conducted away from the household and the sale of honey provides income to some residents. Spraying in areas near beehives can lead to the death of the bees, which are vulnerable to clothianidin. In addition, spraying near hives can lead to contamination of edible honey. These risks must be mitigated at all times. The implementing partner will identify locations where beehives are kept and observe a 30 meter no-spray buffer zone around them.

4.3 DDT

4.3.1 ACUTE TOXICITY

DDT^{5,6,7,8} is moderately to slightly toxic to studied mammalian species via the oral route. DDT is readily absorbed through the gastrointestinal tract, with increased absorption in the presence of fats. DDT is slightly

⁵ <http://extoxnet.orst.edu/pips/ddt.htm>, accessed 8/3/18

to non-toxic to test animals via the dermal route. It is not readily absorbed through the skin unless it is in solution. Acute effects likely in humans due to low to moderate exposure may include nausea, diarrhea, increased liver enzyme activity, irritation (of the eyes, nose, or throat), disturbed gait, malaise, and excitability; at higher doses, tremors and convulsions are possible. Adults appear to tolerate moderate to high ingested doses.

4.3.2 CHRONIC TOXICITY

DDT has caused chronic effects on the nervous system, liver, kidneys, and immune systems in experimental animals. Effects on the nervous system include: tremors in rats; tremors in mice; changes in cellular chemistry in the central nervous system of monkeys, and loss of equilibrium in monkeys. The main effect on the liver seen in animal studies was localized liver damage. In mice DDT caused increased liver weight and increased liver enzyme activity. Liver enzymes are commonly involved in detoxification of foreign compounds, so it is unclear whether increased liver enzyme activity in itself would constitute an adverse effect. In some species (monkeys and hamsters), doses as high as 8-20 mg/kg/day caused no observed adverse effects over exposure periods as long as 3.5-7 years. Dose levels at which effects were observed in test animals are very much higher than those which may be typically encountered by humans. Adverse effects on the liver, kidney, and immune system due to DDT exposure have not been demonstrated in humans in any of the studies which have been conducted to date.

4.3.3 REPRODUCTIVE EFFECTS

There is evidence that DDT causes reproductive effects in test animals. It is thought that many of these observed effects may be the result of disruptions in the endocrine (hormonal) system. Available epidemiological evidence from two studies does not indicate that reproductive effects have occurred in humans as a result of DDT exposure. No associations between maternal blood levels of DDT and miscarriage or premature rupture of fetal membranes were observed in two separate studies. One study did report a significant association between maternal DDT blood levels and miscarriage, but the presence of other organochlorine chemicals (e.g., PCBs) in maternal blood which may have accounted for the effect make it impossible to attribute the effect to DDT and its metabolites.

4.3.4 TERATOGENIC EFFECTS

There is evidence that DDT causes teratogenic effects in test animals. It seems unlikely that teratogenic effects will occur in humans due to DDT at likely exposure levels.

4.3.5 MUTAGENIC EFFECTS

The evidence for mutagenicity and genotoxicity is contradictory. In only one out of 11 mutagenicity assays in various cell cultures and organisms did DDT show positive results. It appears that DDT may have the potential to cause genotoxic effects in humans, but does not appear to be strongly mutagenic. It is unclear whether these effects may occur at exposure levels likely to be encountered by most people.

4.3.6 CARCINOGENIC EFFECTS

The evidence regarding the carcinogenicity of DDT is equivocal. It has been shown to cause increased tumor production (mainly in the liver and lung) in test animals such as rats, mice and hamsters in some studies but not in others. The available epidemiological evidence regarding DDT's carcinogenicity in humans, when taken as a whole, does not suggest that DDT and its metabolites are carcinogenic in humans at likely dose

⁶ Agency for Toxic Substances and Diseases Registry (ATSDR)/US Public Health Service, Toxicological Profile for 4,4'-DDT, 4,4'-DDE, 4, 4'-DDD (Update). 1994. ATSDR. Atlanta, GA.

⁷ World Health Organization (WHO). 1989. Environmental health Criteria 83, DDT and its Derivatives and Environmental Effects. World Health Organization, Geneva.

⁸ US Environmental Protection Agency. 1989. Environmental Fate and Effects Division, Pesticide Environmental Fate One Line Summary: DDT (p, p'). Washington, DC.

levels. In several epidemiological studies, no significant associations were seen between DDT exposure and disease.

4.3.7 ORGAN TOXICITY

Acute human exposure data and animal studies reveal that DDT can affect the nervous system, liver, and kidney. Increased tumor production in the liver and lung has been observed in test animals. An association with pancreatic cancer was suggested in humans in one study.

4.3.8 FATE IN HUMANS & ANIMALS

DDT is very slowly transformed in animal systems. Initial degradates in mammalian systems are 1,1-dichloro-2,2-bis(p-dichlorodiphenyl)ethylene (DDE) and 1,1-dichloro-2,2-bis(p-chlorophenyl)ethane (DDD), which are very readily stored in fatty tissues. These compounds in turn are ultimately transformed into bis(dichlorodiphenyl) acetic acid (DDA) via other metabolites at a very slow rate. DDA, or conjugates of DDA, are readily excreted via the urine. Levels of DDT or metabolites may occur in fatty tissues (e.g. fat cells, the brain, etc.) at levels of up to several hundred times that seen in the blood. DDT or metabolites may also be eliminated via mother's milk by lactating women.

4.3.9 EFFECTS ON BIRDS

DDT may be slightly toxic to practically non-toxic to birds. Reported dietary LD 50s range from greater than 2,240 mg/kg in mallard, 841 mg/kg in Japanese quail and 1,334 mg/kg in pheasant. There has been much concern over chronic exposure of bird species to DDT and effects on reproduction, especially eggshell thinning and embryo deaths. The mechanisms of eggshell thinning are not fully understood. There is evidence that synergism may be possible between DDT's metabolites and organophosphate (cholinesterase-inhibiting) pesticides to produce greater toxicity to the nervous system and higher mortality.

4.3.10 EFFECTS ON AQUATIC SPECIES

DDT is highly toxic to many aquatic invertebrate species. Early developmental stages are more susceptible than adults to DDT's effects. DDT is highly toxic to fish species as well. DDT may be moderately toxic to some amphibian species and larval stages are probably more susceptible than adults. In addition to acute toxic effects, DDT may bioaccumulate significantly in fish and other aquatic species, leading to long-term exposure. This occurs mainly through uptake from sediment and water into aquatic flora and fauna, and also fish. The reported bioconcentration factor for DDT is 1,000 to 1,000,000 in various aquatic species, and bioaccumulation may occur in some species at very low environmental concentrations. Bioaccumulation may also result in exposure to species which prey on fish or other aquatic organisms (e.g., birds of prey).

4.3.11 EFFECTS ON OTHER ANIMALS

DDT is non-toxic to bees; the reported topical LD50 for DDT in honeybees is 27 µg/bee. Earthworms are not susceptible to acute effects of DDT and its metabolites at levels higher than those likely to be found in the environment, but they may serve as an exposure source to species that feed on them. Laboratory studies indicate that bats may be affected by DDT released from stored body fat during long migratory periods.

4.3.12 BREAKDOWN IN SOIL AND GROUNDWATER

DDT is highly persistent in the environment, with a reported half-life of between 2-15 years and is immobile in most soils. Breakdown products in the soil environment are DDE and DDD, which are also highly persistent and have similar chemical and physical properties. Due to its extremely low solubility in water, DDT will be retained to a greater degree by soils and soil fractions with higher proportions of soil organic matter. It may accumulate in the top soil layer in situations where heavy applications are (or were) made annually; e.g., for apples.

4.3.13 BREAKDOWN OF CHEMICAL IN SURFACE WATER

DDT may reach surface waters primarily by runoff, atmospheric transport, drift, or by direct application (e.g. to control mosquito-borne malaria). The reported half-life for DDT in the water environment is 56 days in lake water and approximately 28 days in river water. The main pathways for loss are volatilization, photo-degradation, adsorption to water-borne particulates and sedimentation. Aquatic organisms, as noted above, also readily take up and store DDT and its metabolites. Field and laboratory studies in the United Kingdom demonstrated that very little breakdown of DDT occurred in estuary sediments over the course of 46 days. DDT has been widely detected in ambient surface water sampling in the United States at a median level of 1 ng/L (part per trillion).

4.3.14 BREAKDOWN OF CHEMICAL IN VEGETATION

DDT does not appear to be taken up or stored by plants to a great extent. It was not translocated into alfalfa or soybean plants, and only trace amounts of DDT or its metabolites were observed in carrots, radishes, and turnips all grown in DDT-treated soils. Some accumulation was reported in grain, maize and rice plants, but little translocation occurred and residues were located primarily in the roots.

4.3.15 CUMULATIVE IMPACT

No cumulative impacts are expected as a result of using DDT, clothianidin or formulations with deltamethrin in IRS if PMI BMPs are followed. IVM, including the use of DDT, clothianidin and combinations, should reduce the spread of mosquito-borne disease.

5. SAFER USE ACTION PLAN

The SUAP in Chapter 6 of the 2015 SEA (pp. 37-75) outlines the mitigation methods proposed to mitigate the potential adverse impacts outlined in Chapter 4 of this amendment. This SUAP remains in full force and effect, and governs all activities proposed in this amendment. The primary mitigation measures include delivery of a mix of 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 updated EMMP found in Annex B of this amendment.

ANNEX A: SUMMARY OF ACUTE EXPOSURE SYMPTOMS AND TREATMENT OF CLOTHIANIDIN AND DELTAMETHRIN

Clothianidin	
Human Side Effects	Treatment
<p>Clothianidin is a systemic insecticide belonging to the subgroup of nicotinoid insecticides. It is also referred to as a chloro-nicotinyl or neonicotinoid.⁹ 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.¹⁰ 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. Rare caustic injury to the esophagus has been reported. This is likely due to the solvent component of the insecticide (N-methyl-2-pyrrolidone) as opposed to the neonicotinoid itself.¹¹</p> <p>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.¹²</p>	<p>Management of mild to moderate toxicity— Treatment is symptomatic and supportive. Administer IV fluids for hypotension.</p> <p>Management of severe toxicity—Treatment is symptomatic and supportive. Treat hypotension with IV fluids; add vasopressors if hypotension persists. Treat dysrhythmias per American cardiovascular life support 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 clothianidin insecticides are frequently mixed with organophosphate and carbamate pesticides.¹³</p>

⁹ <http://www.cdpr.ca.gov/docs/registration/ais/publicreports/5792.pdf> Accessed 7/14/17.

¹⁰ <https://toxnet.nlm.nih.gov/cgi-bin/sis/search/a?dbs+hsdb:@term+@DOCNO+7281> Accessed 7/14/17.

¹¹ Ibid.

¹² <http://www.cdpr.ca.gov/docs/registration/ais/publicreports/5792.pdf> Accessed 7/14/17.

¹³ <https://toxnet.nlm.nih.gov/cgi-bin/sis/search/a?dbs+hsdb:@term+@DOCNO+7281> Accessed 7/14/17.

Deltamethrin

Human Side Effects

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. 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 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.”

Treatment

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 4 percent sodium bicarbonate. Vomiting should not be induced following ingestion exposures, but the mouth should be rinsed.

Recommended Medical Stores

Name of Drugs	Active Ingredient(s)
Promethazine	Promethazine Hydrochloride
Panadol	Paracetamol
Lorazepam	Lorazepam
Calamine cream	Calamine, zinc oxide, glycerol, phenol, purified water, sodium citrate, bentonite
Vit E	Tocopherol, fragrance, mineral oil, deionized water, sodium hydroxide, stearic acid
Hydrocortisone cream	1% hydrocortisone
Salbutamol	Salbutamol 100 mcg, suspended inert aerosol
Salbutamol tablets	Salbutamol sulphate 4 mg
Activated Charcoal	Activated Charcoal

ANNEX B: ENVIRONMENTAL MITIGATION AND MONITORING PLAN

Category of Activity	Description of Specific Environmental Threats of Project 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 are recommended for categorical exclusion.	N/A – Categorical Exclusion	N/A	N/A	N/A	N/A
2. Research and Development	Entomological surveillance and vector control research use laboratory equipment, chemical reagents, insecticides, and entomological surveillance supplies	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	Laboratory personnel within the respective country, with oversight provided by Abt Associates technical	EHS manual/Standard operating procedures (SOPs) implemented per PMI and country-specific requirements Training of staff in	Review of EHS manual/SOPs to ensure it is appropriate, and complies with PMI, WHO and country-specific recommendations for safety, use of PPE (if needed),	Routine site visits, as needed, to ensure accordance with operating plan

Category of Activity	Description of Specific Environmental Threats of Project Activities	Description of Mitigation Measures for these Activities	Who is Responsible for Monitoring?	Monitoring Indicator	Monitoring Method	Frequency of Monitoring
	<p>that have the potential to cause adverse health and environmental impacts if not properly managed. These materials require special care and management to minimize their expiration and/or damage.</p>	<p>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.</p> <p>Provide training to workers on the approved SOPs or Waste Management Plan (WMP) developed for properly handling and disposing of wastes.</p>	<p>experts.</p>	<p>activities related to the laboratory EHS manual/SOPs</p>	<p>spill prevention, and training.</p> <p>Review training materials and logs to verify trainings were conducted.</p> <p>Confirm during routine visits that SOPs are being effectively implemented and that workers are reporting EHS incidents.</p> <p>Include date of visits, findings and any non-compliance issues in the annual EMMR.</p> <p>Include photographs from site visits.</p>	

Category of Activity	Description of Specific Environmental Threats of Project Activities	Description of Mitigation Measures for these Activities	Who is Responsible for Monitoring?	Monitoring Indicator	Monitoring Method	Frequency of Monitoring
4. Rehabilitation	<p>Rehabilitation or cosmetic improvements may lead to adverse environmental and health impacts if hazardous materials are present, or if rehabilitation activities are not properly managed. Exposure to certain building materials during rehabilitation activities can result in health impacts to workers.</p>	<p>Implement rehabilitation activities in conformance with USAID best practices and host country laws and regulations. Refer to the “Small-Scale Construction” chapter of the USAID Sector Environmental Guidelines (www.usaidgems.org/sectorGuidelines.htm).</p> <p>Only non-hazardous materials may be used for rehabilitation of facilities. In particular, asbestos and/or lead-based paint or plumbing will not be used, even if allowed by host country.</p> <p>If existing hazardous materials are identified during planning or rehabilitation, implementing partners will cease rehabilitation activities until all such materials have been removed by other qualified parties in compliance with host country regulations.</p> <p>Implementing partners and/or sub-contractors will provide training to workers on applicable best practices.</p>	<p>Abt Associates technical overseers, and sub-contractors, with assistance from IP home office and USAID Missions personnel</p>	<p>Best practices implemented.</p> <p>Records of staff briefings on activities requiring best practices.</p>	<p>Review rehabilitation plans prior to renovations.</p> <p>Reports from sub-contractors during rehabilitation activities.</p>	<p>As required prior to rehabilitation.</p> <p>Weekly during rehabilitation.</p> <p>Prior to disposal of wastes.</p> <p>Final report upon completion of rehabilitation.</p>

Category of Activity	Description of Specific Environmental Threats of Project Activities	Description of Mitigation Measures for these Activities	Who is Responsible for Monitoring?	Monitoring Indicator	Monitoring Method	Frequency of Monitoring
	<p>Rehabilitation of facilities may generate debris and wastes that contain both non-hazardous and hazardous materials and require proper disposal. Workers and others disposing of debris and wastes may experience negative health effects if the appropriate PPE is not used.</p>	<p>Implementing partners and sub-contractors will follow best practices, for properly disposing of waste resulting from renovation or rehabilitation activities. Contractors will train workers on the proper use of PPE, and best practices for handling and disposing of waste.</p> <p>If the presence of asbestos is suspected in a facility to be renovated, the facility must be tested for asbestos before rehabilitation works begins. Should asbestos be present, implementing partners and sub-contractors must cease work until removal is carried out by others in conformity with host country requirements. Work may not recommence until the facility is retested to demonstrate that asbestos removal has been effective.</p> <p>All results of the testing for asbestos shall be communicated to the COR.</p>	<p>Abt Associates EHS managers and sub-contracting supervisors.</p>	<p>Best practices implemented.</p> <p>Correspondence with contractors on renovation waste disposal.</p>	<p>Review of intended best practices to ensure it is adequate.</p> <p>Review records to verify trainings/ briefings were conducted.</p> <p>Receive and review certificates of waste disposal.</p>	<p>At least once, and as required prior to rehabilitation.</p> <p>Once post-rehabilitation but prior to final disposal of wastes.</p>

Category of Activity	Description of Specific Environmental Threats of Project Activities	Description of Mitigation Measures for these Activities	Who is Responsible for Monitoring?	Monitoring Indicator	Monitoring Method	Frequency of Monitoring
7. Vector Control	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).	<p>Insecticide selection for any USAID-supported malaria program is subject to the criteria listed in the USAID Programmatic Environmental Assessment, country SEAs, and host country requirements.</p> <p>Procurement and inventory logs must be maintained.</p> <p>Ensure storage facility and PPE are appropriate for the active ingredient used and in accordance with approved SOPs.</p> <p>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).</p>	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, but may not reflect the exact job title.)	<p>PMI BMPs reviewed and implemented.</p> <p>Procurement and inventory logs maintained.</p> <p>Proper PPE used by workers, if needed.</p> <p>Operations facilities are sited appropriately.</p> <p>All insecticide management records are reviewed and maintained.</p>	<p>Inspection of facilities, conditions, PPE use, and logs.</p> <p>Review of waste management records and storekeeper performance checklists.</p> <p>Verify that inspection reports and storage records are properly maintained and document verification in the annual EMMR.</p> <p>ECO performs mid-application inspections. Verify that inspection reports are properly maintained and document verification in the annual EMMR</p>	<p>Daily monitoring by storekeeper or site supervisor.</p> <p>Weekly monitoring by DC.</p> <p>Monthly review of procurement logs and inventories by OM.</p>

Category of Activity	Description of Specific Environmental Threats of Project Activities	Description of Mitigation Measures for these Activities	Who is Responsible for Monitoring?	Monitoring Indicator	Monitoring Method	Frequency of Monitoring
	2. Occupational risks for workers involved in IRS campaigns.	<p>Inspect and certify vehicles used for insecticide or team transport prior to contract.</p> <p>Train drivers.</p> <p>Ensure availability of cell phone, PPE, and spill kits during insecticide transportation.</p> <p>Initial and 30-day pregnancy testing for female candidates for jobs with potential insecticide contact.</p> <p>Health test all spray team members for duty fitness.</p> <p>Procure, distribute, and train all workers with potential insecticide contact on the use of PPE.</p> <p>Train operators on mixing insecticides and the proper use and maintenance of application equipment.</p> <p>Provide adequate facilities and supplies for end-of-day cleanup.</p> <p>Enforce application and clean-up procedures.</p>	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>d. Records are kept of pregnancy testing for all female team members.</p> <p>e. Medical exam results are kept 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,</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-application inspections of PPE use and operator performance.</p> <p>i. Monitoring of on-line database for submission of inspection reports.</p>	<p>a-c. Two inspections per week. d-e. One inspection per campaign, additional inspection if new hires or more than 30 application days.</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	Description of Specific Environmental Threats of Project Activities	Description of Mitigation Measures for these Activities	Who is Responsible for Monitoring?	Monitoring Indicator	Monitoring Method	Frequency of Monitoring
				<p>and equipment does not leak.</p> <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>		
	<p>3. Health and safety risks for residents of treated houses (e.g., risks from skin contact and/or ingestion of insecticides)</p>	<p>a. Implement 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</p> <p>b. Ensure health facility staff are aware of insecticide poisoning management</p>	<p>IEC officers, OM, ECO, host country Ministry of Health/Environment officials.</p>	<p>Review IEC materials and records and execute pre-application IEC campaigns.</p>	<p>Review IEC materials and records to verify IEC pre-application campaigns were conducted and homeowners were informed of responsibilities and precautions.</p>	<p>Review IEC materials once per campaign</p>

Category of Activity	Description of Specific Environmental Threats of Project Activities	Description of Mitigation Measures for these Activities	Who is Responsible for Monitoring?	Monitoring Indicator	Monitoring Method	Frequency of Monitoring
	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.	<p>Storage facilities and transportation vehicles must be physically secured to prevent theft.</p> <p>Maintain records of all insecticide receipts, issuance, and return of empty containers.</p> <p>Conduct analysis comparing number of houses treated vs. number of containers used.</p> <p>Examine houses treated to confirm application.</p> <p>Perform physical inventory counts during the application season.</p>	Storekeepers, District coordinators, sector managers, logistics coordinator, OM, ECO.	<p>Storage facilities and transportation vehicles are secured.</p> <p>All insecticide management records are reconciled.</p>	<p>Inspection of storage facilities and transportation vehicles.</p> <p>Inspection of insecticide management records.</p> <p>Storekeeper performance checklists.</p> <p>ECO mid-campaign inspections.</p>	<p>Daily monitoring by storekeeper or site supervisor.</p> <p>Weekly monitoring by District Coordinator.</p> <p>Examine houses during campaign according to schedule in SOPs.</p> <p>Physical inventory counts twice per campaign per store room.</p>
	5. Ecological risk to non-target species and water bodies from use of insecticides	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	DC, OM, ECO	<p>Training materials and records.</p> <p>Equipment is maintained and operated to eliminate leaks.</p> <p>Applicators only mix and apply insecticides</p>	<p>Review training materials and records to verify trainings were conducted.</p> <p>Conduct inspections during operations.</p> <p>Verify that inspection and</p>	<p>Inspect work records once per campaign.</p> <p>Inspections during operations 3 times per week.</p> <p>Review training materials once per campaign.</p>

Category of Activity	Description of Specific Environmental Threats of Project Activities	Description of Mitigation Measures for these Activities	Who is Responsible for Monitoring?	Monitoring Indicator	Monitoring Method	Frequency of Monitoring
		<p>the personal protective equipment to be worn when handling the barrel.</p> <p>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.</p> <p>Ensure application equipment and PPE are appropriate for the active ingredient used and in accordance with approved SOPs, and maintain equipment to avoid leaks.</p> <p>Maintain application equipment.</p> <p>No application of insecticides within 30 yards of beekeeping sites.</p>		according to SOPs.	incident reports are properly maintained and document verification in the annual EMMR. Include any issues identified during inspections in the annual EMMR.	
6. Environmental risk from disposal of liquid and solid wastes.		a. 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	DC, OM, ECO	<p>a. WMP implemented and disposal sites inspected and certified before campaigns.</p> <p>b. Disposal sites</p>	<p>a. Review WMP/SOPs to ensure it conforms to PMI BMPs and WMP is available on site.</p> <p>b-c. Pre-spray</p>	<p>a-b. Pre-spray inspections: once per campaign.</p> <p>c. pre-spray inspection 1/yr.</p> <p>d-e. Mid-spray</p>

Category of Activity	Description of Specific Environmental Threats of Project Activities	Description of Mitigation Measures for these Activities	Who is Responsible for Monitoring?	Monitoring Indicator	Monitoring Method	Frequency of Monitoring
		<p>waste processes, must be in accordance with PMI best practices and host country requirements.</p> <p>b. Choose sites for disposal of liquid wastes, including fixed and mobile soak pit sites according to PMI BMPs.</p> <p>c. Construct fixed and mobile soak pits with charcoal according to the BMPs to adsorb insecticide from rinse water.</p> <p>d. Maintain soak pits as necessary during season.</p> <p>e. Monitor waste storage and management during campaign.</p> <p>f. Monitor disposal procedures post-campaign.</p>		<p>near operations sites are appropriate according to PMI BMPs.</p> <p>c. Soak pits are constructed according to PMI BMPs.</p> <p>d. Soak pits perform properly throughout the application season.</p> <p>e. Wastes are stored and managed according to PMI BMPs.</p> <p>f. Waste disposal is conducted in accordance with the WMP/SOPs and records maintained.</p>	<p>inspections. d-e. Mid- and post-spray inspections and monitoring. Verify that inspection reports are properly maintained and document verification in the annual EMMR. Include any issues identified during inspections in the annual EMMR.</p> <p>f. Verify disposal practices in inspection reports and document in the annual EMMR. Include any issues identified during inspections in the annual EMMR.</p> <p>Review WMP/SOPs to for effectiveness and maintain on site.</p>	<p>inspections: twice per campaign w review of WMP/SOPs.</p> <p>f. Post-spray inspection 1/yr.</p>

Category of Activity	Description of Specific Environmental Threats of Project Activities	Description of Mitigation Measures for these Activities	Who is Responsible for Monitoring?	Monitoring Indicator	Monitoring Method	Frequency of Monitoring
	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.	<p>a. Wastes will only be disposed in incinerators that comply with PMI BMPs.</p> <p>b. Country-level USAID EC documentation must contain guidance on proper disposal of wastes.</p>	COR, Abt ECO, Abt Technical Experts	<p>a. Incinerator specifications.</p> <p>Maintenance of treatment and disposal records.</p> <p>Reg 216 documentation for incinerator procurement and management services reviewed by COR and GH BEO.</p>	a-b. Review incineration records and EC documentation, document in the annual EMMR.	<p>a. Review incinerator specifications prior to disposal arrangement.</p> <p>b. Annual review of EC docs and disposal records</p>

Category of Activity	Description of Specific Environmental Threats of Project Activities	Description of Mitigation Measures for these Activities	Who is Responsible for Monitoring?	Monitoring Indicator	Monitoring Method	Frequency of Monitoring
8. Testing of Insecticide-Treated Nets	<p>1. Risk of theft from storerooms, followed by unintended use.</p> <p>2. Pollution from improper disposal of packaging.</p> <p>3. Surface or groundwater pollution from improper disposal of wastewater from washing nets.</p> <p>4. Risk of the use of nets for purposes for which they are not designed or intended.</p>	<p>a. Store nets only in storerooms secured with sturdy doors, double locks, and barred windows.</p> <p>b. Dispose of waste materials according to PMI BMPs.</p>	a-b Environmental Compliance Officer, USAID Mission	<p>a. Storerooms are built or modified to meet PMI BMPs.</p> <p>b. Evidence of a compliant disposal program in place.</p>	<p>a. Inspection of storeroom using checklists.</p> <p>b. Inspection of disposal/destruction records.</p>	a-b. Once per fiscal quarter.

ANNEX C: ENVIRONMENTAL MITIGATION AND MONITORING REPORT

Implementing organization: Abt Associates, Inc.
Geographic location of USAID-funded activities: Zambia
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
2. Research and Development <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 style="text-align: center;">List each Mitigation Measure from column 3 in the EMMP (EMMT Part 2 of 3)</p>	<p style="text-align: center;">Status of Mitigation Measures</p>	<p style="text-align: center;">List any Outstanding Issues Relating to Required Conditions</p>	<p style="text-align: center;">Remarks</p>
<p>4. Rehabilitation of Facilities</p> <ul style="list-style-type: none"> • Implement rehabilitation activities in conformance with USAID best practices and host country laws and regulations. Refer to the “Small-Scale Construction” chapter of the USAID Sector Environmental Guidelines (www.usaidgems.org/sectorGuidelines.htm). • Only non-hazardous materials may be used for rehabilitation of facilities. In particular, asbestos and/or lead-based paint or plumbing will not be used, even if allowed by host country. • If existing hazardous materials are identified during planning or rehabilitation, implementing partners will cease rehabilitation activities until all such materials have been removed by other qualified parties in compliance with host country regulations. If the presence of asbestos is suspected in a facility to be renovated, the facility must be tested for asbestos before rehabilitation works begins. Should asbestos be present, implementing partners and sub-contractors must cease work until removal is carried out by others in conformity with host country requirements. Work may not recommence until the facility is retested to demonstrate that asbestos removal has been effective. All results of the testing for asbestos shall be communicated to the COR. • Implementing partners and/or sub-contractors will provide training to workers on applicable best practices. 			
<ul style="list-style-type: none"> • Implementing partners and sub-contractors will follow best practices, for properly disposing of waste resulting from rehabilitation activities. Contractors will train workers on the proper use of PPE, and best practices for handling and disposing of waste. 			

<p style="text-align: center;">List each Mitigation Measure from column 3 in the EMMP (EMMT Part 2 of 3)</p>	<p style="text-align: center;">Status of Mitigation Measures</p>	<p style="text-align: center;">List any Outstanding Issues Relating to Required Conditions</p>	<p style="text-align: center;">Remarks</p>
<p>7. Vector Control</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. • Ensure storage facility and 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). 			
<p>Worker Safety</p> <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, 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>Safety of Beneficiaries</p> <ul style="list-style-type: none"> • Implement 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 			

<p style="text-align: center;">List each Mitigation Measure from column 3 in the EMMP (EMMT Part 2 of 3)</p>	<p style="text-align: center;">Status of Mitigation Measures</p>	<p style="text-align: center;">List any Outstanding Issues Relating to Required Conditions</p>	<p style="text-align: center;">Remarks</p>
<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 and full 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. 			
<p>Environmental Safety</p> <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 waste management plan, 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 SOPs, and maintain application equipment to avoid leaks. • No application of insecticides within 30 yards of beekeeping sites. 			

<p style="text-align: center;">List each Mitigation Measure from column 3 in the EMMP (EMMT Part 2 of 3)</p>	<p style="text-align: center;">Status of Mitigation Measures</p>	<p style="text-align: center;">List any Outstanding Issues Relating to Required Conditions</p>	<p style="text-align: center;">Remarks</p>
<p>Waste Management</p> <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. 			
<p>Incineration of Wastes</p> <ul style="list-style-type: none"> • Wastes will only be disposed in incinerators that comply with PMI BMPs. • Country-level USAID EC documentation must contain guidance on proper disposal of wastes. 			
<p>Insecticide-Treated Nets</p> <ul style="list-style-type: none"> • Store nets only in storerooms secured with sturdy doors, double locks, and barred windows. • Dispose of waste materials according to PMI BMPs. 			

ANNEX D: BIBLIOGRAPHY

Abt Associates, August 2012. Assessment and Recommendations: Storage, Stock Control, and Inventory Management. USAID.

Abt Associates, September 2015. Zambia SEA 2015 – 2020.

IVM PEA, 2017. Integrated vector management programs for malaria vector control (version 2017). USAID.

USEPA, 2003. Assessment Report. Pesticides Facts sheets. Office of Prevention, Pesticide and Toxic Substances (May 30, 2003).

WHO, 2012. Global plan for insecticide resistance management in malaria vectors. World Health Organization, Geneva.

WHO, 2013. Test procedures for insecticide resistance monitoring in malaria vectors. World Health Organization, Geneva.

WHO-UNEP, 2006. Sound Management of Pesticides and Diagnosis and Treatment of Pesticide Poisoning: A Resource Tool. World Health Organization, Geneva.