



SUPPLEMENTAL ENVIRONMENTAL ASSESSMENT AMENDMENT AND PRE-SPRAY LETTER REPORT 2012

MALI INDOOR RESIDUAL SPRAY (IRS2) FOR MALARIA CONTROL

INDEFINITE QUANTITY CONTRACT (IQC) TASK ORDER 4
CONTRACT GHN-I-00-09-00013

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Submitted to: Teresa Bernhard, GH Bureau Environmental Officer

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PROPOSED SUPPLEMENTAL ENVIRONMENTAL ASSESSMENT (SEA) AMENDMENT

1. It is proposed to amend the distribution and authorization requirements of the annual Letter Report. In the April 2011 amendment to the Mali IRS SEA, it was specified that the Letter Report should be distributed to the Mission Environmental Officer (MEO), Regional Environmental Advisor (REA), and the Africa and Global Health Bureau Environmental Officers (BEO) for approval. This Amendment and Letter Report proposes to further amend the Mali SEA such that only Global Health BEO approval signature is required, and only in the case that a Letter Report contains a recommendation to use organophosphates in an upcoming spray campaign. If organo-chlorines (DDT) were to be proposed for use, an amendment to the SEA will still need to be written and approved through the MEO, REA, and BEO signature cycle.

Signature approval of this SEA amendment and Letter Report will indicate acceptance of this proposal, and in the future, only distribution, rather than distribution and approval, of the Letter Report to the MEO, REA, and Africa Bureau BEO will be required if only carbamates or pyrethroids are proposed for use. Therefore, the following conditions will apply.

1. The current (2011) SEA authorizes the use of pyrethroids, carbamates, and organophosphates. An amendment to this SEA would be required if the use of DDT or a new class of insecticide were proposed.
2. The SEA will be updated every five years,
3. If only carbamates or pyrethroids are proposed for use, a Letter Report will be submitted to the Global Health Bureau Environmental Officer for informational purposes only. If organophosphates are proposed for use, the Letter Report will need to be approved by the Global Health Bureau Environmental Officer.

**AMENDMENT TO THE SUPPLEMENTAL ENVIRONMENTAL ASSESSMENT FOR
PRESIDENT'S MALARIA INITIATIVE- INDOOR RESIDUAL SPRAYING (IRS) FOR
MALARIA CONTROL IN MALI**

APPROVAL OF ENVIRONMENTAL ACTION RECOMMENDED:

The United States Agency for International Development, Global Health Bureau has determined that the proposed indoor residual spraying effort, as described in the Supplemental Environmental Assessment: Indoor Residual Spraying for malaria control in Mali dated May 2011 and its amendments, responds to the needs of the community and country as it relates to managing malaria in Mali as well as conforms to the requirements established in 22 CFR 216.

This document does not mandate the execution of the proposed IRS, rather, 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 are established to avoid and reduce any potential impact. USAID has concluded that the proposed action, when executed as described in the Supplemental Environmental Assessment and the Programmatic Environmental Assessment, is consistent with USAID's goal of reducing malaria incidence in Mali while minimizing negative impact to environmental and human health.

CONCURRENCE:

Bureau Environmental Officer, Global Health:


Date: 7/26/2012
Teresa Bernhard

ADDITIONAL CLEARANCES:

Mission Environmental Officer

USAID/Mali: _____ Date: _____

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ACRONYMS

AIRS	Africa Indoor Residual Spray
CDC	Centers for Disease Control
DNACPN	Direction National de l'Assainissement et du Contrôle des Pollutions et des Nuisances
GHI	Global Health Initiative
ITN	insecticide-treated mosquito nets
ITPp	intermittent preventive treatment for pregnant women
MRTC	Malaria Research Training Center
NMCP	National Malaria Control Program
NGO	non-governmental organization
OMS/AFRO	World Health Organization, Africa Regional Office
PMI	President's Malaria Initiative
PNLP	Programme National de lutte contre le Paludisme
TO4	Task Order 4
USAID	United States Agency for International Development
USG	United States Government

EXECUTIVE SUMMARY

This report discusses the preparedness of the Mali AIRS team, facilities, and equipment to conduct the 2012 indoor residual spray rounds in Mali, and serves to document the collaborative efforts and discussions that have led to the strategy and tactics for the proposed 2012 Indoor Residual Spray (IRS) campaign.

Malaria prevention and control is a major foreign assistance objective of the U.S. Government (USG). In May 2009, President Barack Obama announced the Global Health Initiative (GHI), a multi-year, comprehensive effort to reduce the burden of disease and promote healthy communities and families around the world. Through the GHI, the United States will help partner countries improve health outcomes, with a particular focus on improving the health of women, newborns, and children. The President's Malaria Initiative (PMI) is a core component of the GHI. The PMI was launched in June 2005 as a 5-year, \$1.2 billion initiative to rapidly scale up malaria prevention and treatment interventions and reduce malaria-related mortality by 50% in 15 high-burden countries in sub-Saharan Africa. With passage of the 2008 Lantos-Hyde Act, funding for PMI has now been extended through USG FY 2014, and extended the number of countries assisted to nineteen. To achieve its goals, the PMI is utilizing four highly effective interventions including insecticide-treated mosquito nets, indoor residual spraying (IRS) of households with insecticides, intermittent preventive treatment for pregnant women, and prompt use of artemisinin-based combination therapies for those who have been diagnosed with malaria.

In August 2011, Abt Associates was awarded a three-year IRS contract which is funded by USAID under PMI. The objective of the project is to limit exposure to malaria and reduce incidence and prevalence of malaria in sub-Saharan Africa by implementing highly effective indoor residual spraying campaigns. During year one, the project will be implemented in 14 countries including Angola, Benin, Burkina Faso, Ethiopia, Ghana, Liberia, Madagascar, Mali, Mozambique, Nigeria, Rwanda, Senegal, Zambia, and Zimbabwe. Abt will work closely with Ministries of Health, and National Malaria Control Programs (NMCPs), district health offices, local NGOs, and community and business leaders, to ensure that governments, the private sector, and communities are able to lead future IRS and malaria control programs.

Mali is a malaria endemic country that requires intensive malaria prevention and control measures. Malaria is a major cause of morbidity and mortality in the country, causing suffering and death to many people annually. The Ministry of Health—operating through the NMCP and in cooperation with the United States

Government (USG), via the U.S. President's Malaria Initiative (PMI)—has agreed to intensify malaria control and prevention efforts in Mali.

The 2012 PMI IRS campaign in Mali will be the fifth overall, and marks the first to be managed by Abt Associates, Inc., under the IRS TO4 contract.

The pre-spray inspection, which is summarized in Annex B, revealed the strengths and short-comings of the infrastructure and inventory currently available to support the 2012 IRS campaign. Based on these results, a plan has been put in place to correct the deficiencies in soak pits, storerooms, and systems by July 11, prior to the commencement of spray activities on or about July 23, 2012. Although there is typically deterioration of facilities in between spray seasons, the project will be continuously on alert to look for ways to make these facilities more sustainable, using more durable materials whenever possible. This will require investment over time, but in such a way as to minimize the impact on the project scope.

I. BACKGROUND

I.1 INTRODUCTION

Launched in 2005, the President's Malaria Initiative (PMI) is a five-year, \$1.2 billion expansion of U.S. Government efforts to reduce the intolerable burden of malaria and help relieve poverty on the African continent. The goal of PMI is to reduce malaria-related deaths by 50 percent in 19 countries in Africa that have a high burden of malaria by expanding coverage of four highly effective malaria prevention and treatment measures to the most vulnerable populations: pregnant women and children under five years of age. These interventions include insecticide-treated mosquito nets (ITNs), indoor residual spraying (IRS) with insecticides, intermittent preventive treatment for pregnant women (IPTp), and prompt use of artemisinin-based combination therapies (ACTs) for those who have been diagnosed with malaria.

The 2008 Lantos-Hyde Act authorized an expanded PMI program for 2009-2013. PMI is a key component of the U.S. Government's Global Health Initiative, which was announced by President Obama in May 2009. As a result, the PMI strategy [PDF, 483KB] was revised to achieve Africa-wide impact by halving the burden of malaria in 70 percent of at-risk populations in sub-Saharan Africa – or approximately 450 million people. Now in its seventh year of funding, PMI has expanded to 19 countries plus one region. PMI, in partnership with National Malaria Control Programs (NMCP) and in support of country-level strategic plans, is providing technical, managerial, and commodity support for IRS campaigns in all 19 PMI countries.

For 2012, the Mali National Malaria Control Program (NMCP/PNLP), with the support of the US Agency for International Development (USAID) under the United States President's Malaria Initiative (PMI) has agreed to implement indoor spraying in three districts in Mali. Those districts are Bla, Koulikoro, and Baroueli, which was added in 2011.

I.1.1 PROGRAM UPDATE

In August 2011, Abt Associates was awarded a three-year IRS contract which is funded by USAID under PMI. During year one, the project will be implemented in 14 countries including Angola, Benin, Burkina Faso, Ethiopia, Ghana, Liberia, Madagascar, Mali, Mozambique, Nigeria, Rwanda, Senegal, Zambia, and Zimbabwe.

In each country, Abt normally works closely with Ministries of Health, National Malaria Control Programs (NMCPs), district health offices, local NGOs, and community and business leaders, to ensure that governments, the private sector, and communities are able to lead future IRS and malaria control programs. In the case of Mali in 2012, operations will be complicated by the inability of AIRS-Mali staff to work with the government as closely as they are used to.

A rapid start-up team was deployed to Mali from October 9, 2011 through October 21, 2011. While in-country, the start-up team interviewed candidates for all existing positions and newly created positions. The start-up team also visited RTI's project office in Bamako, but decided to house the project in a new office, since AIRS Mali will have more staff members. Arrangements have been made to retain the IRS campaign warehouses in Bla, Baroueli, and Koulikoro.

Additionally, the start-up team met with PMI-Mali, USAID-Mali, the National Malaria Control Program (NMCP), Malaria Research Training Center (MRTC), one of the Centers for Disease Control (CDC)'s Entomologists (assigned to supporting PMI-Mali), and health officials at the national and district levels. These meetings provided valuable information to determine the roles and responsibilities of Abt as it continues IRS implementation, and to gain information regarding the strengths and weaknesses of current and past IRS project implementation.

Due to concerns about the effectiveness of carbamate on structure walls after three months, and noting that September is the peak malaria transmission season in the spray districts, MRTC and PMI-Mali recommended that the IRS spray campaign shift from June-July to July-August in 2012. AIRS Mali will comply with this recommendation, and will organize the schedule of the IRS campaign to adhere to the recommendations by MRTC and PMI-Mali.

1.1.2 STATE OF MALARIAL PATHOGENS, VECTORS, AND TRANSMISSION IN MALI

Malaria is the primary cause of morbidity and mortality in Mali, particularly among children under the age of five. The disease is endemic in the central and southern regions (where over 90 percent of Mali's population lives) and considered epidemic in the north. In 2010, the national health information system reported that malaria accounted for 45 percent of all medical consultations. However, fewer than half of these cases were confirmed by either microscopy or rapid diagnostic tests (RDTs). Malaria also accounts for 51 percent of all outpatient visits for children under five.

The most common malaria pathogens in Mali are (Dumbo et al., 1991, 1992)

- *Plasmodium falciparum*, contributing 85–90% of the parasite count, and accounting for the lethal and complicated forms of malaria in Mali.
- *Plasmodium malariae*, contributing 10–14% of the parasite count
- *Plasmodium ovale*, contributing 1% of the parasite count.

The main vectors of malaria in Mali are (Touré et al., 1986, 1998)

- *Anopheles gambiae*
- *Anopheles arabiensis*
- *Anopheles funestus*

1.1.3 HISTORY AND SCOPE OF IRS IN MALI

The PMI program in Mali began in 2008, using pyrethroids, in the health districts of Bla and Koulikoro. In 2011, the program was extended to Barouéli district, and the pesticide was changed to bendiocarb, because of incipient resistance to pyrethroids. In 2012 there are no changes in coverage or pesticide proposed, therefore, pending acceptance of this Letter Report and amendment to the Supplemental Environmental Assessment, the same three districts will be sprayed and bendiocarb will again be used.

1.1.4 POLITICAL CLIMATE

In 2012, the government of Mali experienced instability, with the deposition of the president and the military taking control. PMI/USAID suspended all activities in Mali for about two months, which resulted in a delay to the start of preparatory activities for the campaign, and has led to a compressed schedule for operations.

1.1.5 IRS OBJECTIVES AND STRATEGY

1.1.5.1 KEY TARGETS AND OBJECTIVES IN 2012

For 2012, AIRS will complete an IRS campaign to cover around 215,000 eligible structures in Bla, Koulikoro, and Baroueli districts. Below are the key overall objectives for the IRS project in Mali during 2012.

- Cover at least 85% of targeted and eligible structures found in all 3 districts (Baroueli, Bla, and Koulikoro)
- Promote a participatory implementation (at all levels) of the IRS operations in the three health districts of Baroueli, Koulikoro, and Bla.
- Continue efforts to develop national and local capacity in organizing, planning, implementation, and evaluating IRS campaigns, with a goal of identifying a plan for sustainability. Support training and capacity building with a focus on the host government at national and lower levels to achieve greater sustainability of IRS.
- Participate in the development of a national IRS strategy document to ensure that the extension and sustainability approaches are taken into account in the national IRS strategic plan
- Contribute to an updated national-level IRS training manual
- Support orientation on and dissemination workshops on national IRS strategic documents to the sub-regional levels

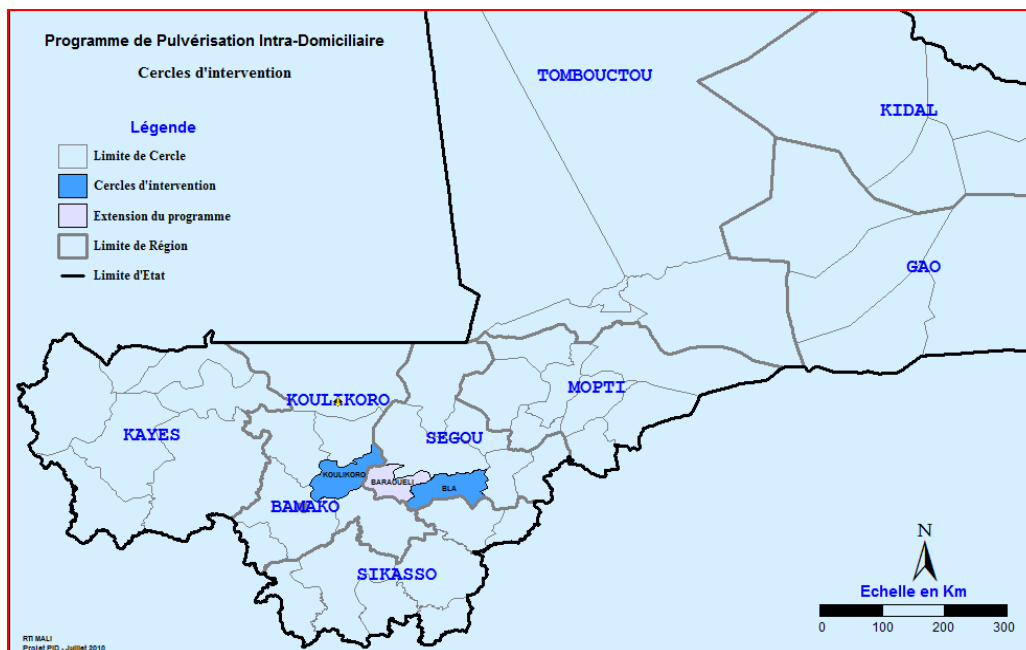


FIGURE 1: MAP OF THE REPUBLIC OF MALI SHOWING TARGETED DISTRICTS

2. INSECTICIDE PROPOSED

From 2008 to 2010, pyrethroids (Lambdacyhalothrin, Deltamethrin) were used in Bla and Koulikoro Districts. In 2011, the IRS program was extended to Barouéli and that year, because of developing resistance to pyrethroids, bendiocarb, a carbamate, was chosen for use in the three districts (Bla, Koulikoro, Barouéli). Bendiocarb is also the insecticide proposed for use in 2012, based on the successful results of the IRS monitoring that took place in Mali in June, 2011.

See Annex III for health and environmental effects of bendiocarb toxicity, including symptoms to be monitored among operators and other potentially exposed individuals.

Participants in the decision to use Bendiocarb include:

- Ministère de la santé du Mali,
- Ministère de l'agriculture du Mali,
- Programme National de lutte contre le Paludisme du Mali,
- Direction National de l'Assainissement et du Contrôle des Pollutions et des Nuisances(DNACPN)
- USAID-PMI, Mali
- OMS/AFRO, Mali
- Malaria Research and Training Center (MRTC), Bamako, Mali

2.1 ENTOMOLOGY

The 2011 tests were conducted to determine the quality of spraying and the efficacy of the sprayed surface in killing mosquitoes. Overall the average mortality rates 24 hours after exposure to bendiocarb-sprayed walls were high. Mosquitoes known to be susceptible to carbamates (colony-reared *An. gambiae*, Kisumu strain) were used for the assays. Ten mosquitoes were exposed, in a cone, to each of the four walls of five selected houses in each village. Ten others were placed in a cone fixed on a cardboard and all fixed on a wall, which was the control. Only in Kamba, one of the three villages in Baroueli were low mortality rates obtained. This could be explained by several factors including the material of the walls, the application, the variability in cone bio-assays etc.

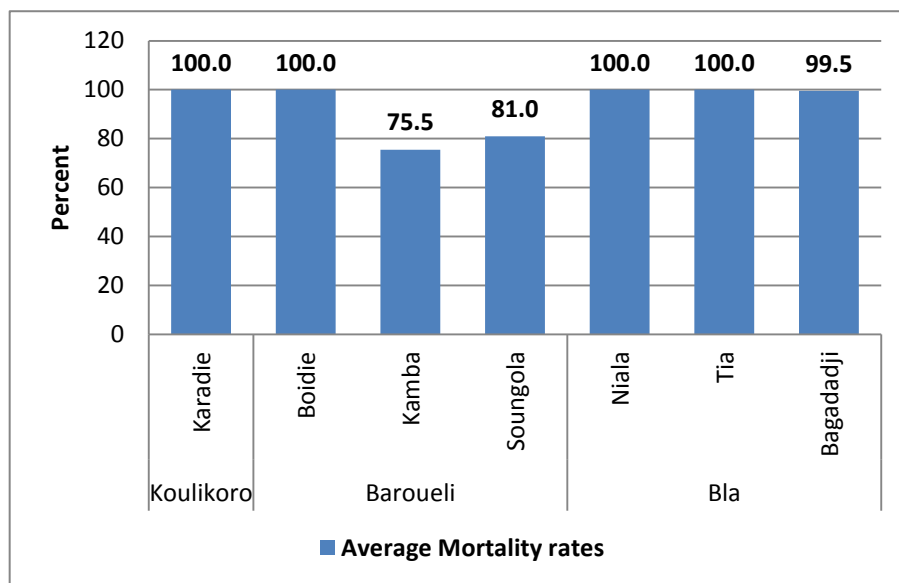


FIGURE 2: AVERAGE MORTALITY RATES 24 HOURS AFTER EXPOSURE OF ANOPHELES GAMBIAE KISUMU TO IRS TREATED WALLS IN KARADIE (KOULIKORO DISTRICT), BOIDIE, KAMBA AND SOUNGOLA (BAROUELI DISTRICT) AND IN NIALA, TIA AND BAGADADJI (BLA DISTRICT) IN 2011.

Results from individual villages listed below:

Karadie (Koulikoro district)

On June 26th 2011 cone bio-assays were conducted in five randomly selected rooms in the village of Karadie. The average mortality rate 24 hours after exposure mosquitoes were 100% in each of the five rooms.

Boidie (Baroueli district)

On June 24th 2011 cone bio-assays were conducted in five randomly selected rooms in the village of Boidie. The average mortality rate 24 hours after exposure of mosquitoes was 100% in each of the five rooms.

Kamba (Baroueli district)

On June 22th 2011, cone bio-assays were conducted in five randomly selected rooms in the village of Kamba. The average mortality rate in the five rooms 24 hours after exposure of mosquitoes was 75.5%. The table below shows the mortality rates per room and the average.

TABLE 1: MORTALITY RESULTS FROM KAMBA

Results and Documentation	Room 1	Room 2	Room 3	Room 4	Room 5	Average/All rooms
Average Mortality (%) / room	62.5	100.0	45.0	90.0	80.0	75.5

Soungola (Baroueli district)

On June 23th 2011 cone bio-assays were conducted in five randomly selected rooms in the village of Soungola. The average mortality rate in the five rooms 24 hours after exposure of mosquitoes was 81.0%. The table below shows the mortality rates per room and the average.

TABLE 2: MORTALITY RESULTS FROM SOUNGOLA

	Room 1	Room 2	Room 3	Room 4	Room 5	Average/All rooms
Average Mortality (%) / room	82.5	87.5	83.3	87.5	62.5	81.0

Niala (Bla district)

On June 30th 2011 cone bio-assays were conducted in five randomly selected rooms in the village of Niala. The average mortality rate in the five rooms 24 hours after exposure of mosquitoes was 100%.

Tia (Bla district)

On June 29th 2011 cone bio-assays were conducted in five randomly selected rooms in the village of Tia. The average mortality rate in the five rooms 24 hours after exposure of mosquitoes was 100%.

Bagadadji (Bla district)

On June 29th 2011 cone bio-assays were conducted in five randomly selected rooms in the village of Bagadadji. The average mortality rate in the five rooms 24 hours after exposure of mosquitoes was 99.5 %. The table below shows the mortality rates per room and the average.

TABLE 3: MORTALITY RESULTS FROM BAGADADJI

	Room1	Room2	Room3	Room4	Room5	Average
Mean Mortality (%)	100.0	100.0	100.0	100.0	97.5	99.5

Remarks, comments, and conclusions:

In Koulikoro the second village (Koula) was not sprayed when we conducted the cone assays.

Unfortunately, despite several requests, AIRS Mali does not have access to any resistance studies performed by MRTC in 2011. NMCP and PMI Mali, along with the other stakeholders listed above have proposed to use carbamates for the 2012 spray season.

There are two sets of inventory left over from the previous year. Within that inventory, there are 15,360 sachets with an expiration date of March 2015 and 164 sachets with an expiration date of February 2016.

2.2.2 CALCULATION OF AMOUNT TO BE PURCHASED

TABLE 6: INSECTICIDE QUANTITY EVALUATION PROCESS

Practical Test June 2011		(01) Sachet / 06 Rooms of 3m2	
Theoretical 250 m2 For (01) Sachet			
Nbr Structures	208,998		2011
Nbr Rooms	417,996	Average (02) rooms / Structure	
1Sachet	6Room		
Sachets as a function of Nbr structures	69,666		
10% Factor Spares	76,632	Sachets	
2011 Stock	15,524	Sachets	
Quantity to be Ordered	61,108	Sachets	
Weight to be Ordered	7,638,575	g = 7,638Kg	

3. MALI ENVIRONMENTAL LAWS AND REGULATIONS

The Malian constitution recognizes all citizens' "right to a healthy environment" and stipulates in article 15 that the "protection of the environment and the assurance of quality of life is the purpose and responsibility of the state". We will ensure that norms regarding the protection of the environment will be respected.

Decree 03-594/PRM of December 31 2003 refers to the Environmental Impact Assessment, which outlines the rules, regulations and procedures that a private or public project must include. We have completed the Government of Mali's requirement to do an in-country environmental assessment. It was reviewed and approved by the DNACPN (the National Public health and Pollution Prevention Ministry).

Decree 02-305 concerns the protection of vegetables. We are obliged to respect the protection of agricultural practices in the areas where IRS will be conducted. This decree enforces the protection of crop production.

Order 01-046/PRM of September 20 2001 authorizes the ratification of the Communal Regulation of member states of the CILSS (Inter-State Committee for Drought Control in the Sahel) on the registration of pesticides signed in Djamena on December 16 1999. We will not be permitted to import and or procure any pesticide without the documentation that its exact composition is registered in country. Registration has been effected for bendiocarb.

Law 89-61/AN-RM of September 2 1989 states that the importation of toxic waste will be prohibited. We will not be involved in the importation of toxic waste.

Law 02-14/AN-PR of June 3 2002 institutes the registration and the management of pesticides in the Republic of Mali. It states overall general principles on matters surrounding their importation, their chemical composition, packaging, repackaging, and the storage of pesticides. After the pesticide sachets are used we will transfer these materials to the DNACPN, in charge on the inter-state African Program (part of the United Nations) for the disposal of Obsolete Pesticides for removal.

Law 01-20/AN-RM of April 26 2001 stipulates that harmful chemical substances "which can "pose a danger to man or his environment are subject to tight regulation and inspections by Ministries in charge of Environment and Public Safety." With respect to this law, we will ensure that all personnel hired to conduct IRS will handle the pesticides and abide by the most stringent of safety rules and will have the proper protective equipment to prevent and mitigate exposure. (This is explained in greater depth in the following chapters).

Order 02-049/P-RM of March 29 2002 on the Creation of the Niger Bassin Agency outlines the roles and responsibilities of the Niger River Basin Agency, which include the "preservation of the River, including the protection of terrestrial and aquatic ecosystems." Through the proper compliance of this SEA and proper training of spray teams, we will respect and comply with the demands of the River Niger Basin Agency, and will respect basin environments to ensure there is no contamination of its flora and fauna.

Law 02-006 of January 31 2002 maintains that the conservation, protection and management of water resources is obligatory by the Ministry of Environment and must be respected by all. Article 14 states that it is strictly prohibited to spill and contaminate the water bodies and their flora and fauna.

We must respect this law, and have taken precautionary measures to avoid spraying in areas where contamination risk is high, such as near the dam in N'Togosso, in the Cercle of Bla. Contamination of the River Niger and its tributaries would be detrimental to the local economies.

4. OPERATIONS AND LOGISTICS

4.1.1 INFRASTRUCTURE AND HUMAN RESOURCES

4.1.1.1 PERSONNEL

The Mali country team is composed of 13 full time staff members, and one part-time staff member (the IT Specialist is shared with Abt's two other Mali projects).

4.1.1.2 STOREROOMS

The project is retaining its leases for its three warehouses in Bla, Koulikoro, and Baroueli. Warehouse Managers (previously employed by RTI) in Bla, Baroueli, and Koulikoro have been retained, as Abt has renewed their service agreements. Additionally AIRS Mali may hire two F&A Assistants to help process payments and various accounting issues during the IRS campaign.

4.1.1.3 VEHICLES

Land Cruiser 4x4: Two for each district (total of six) for IRS district overseers.

Land Cruiser Pick Up: One for each district (total of three) for insecticide and materials transport

Minibuses: 32 for Bla district, 22 for Koulikoro District and 27 for Barouéli District (total of 81): Used for spray operator transportation.

IRS vehicles will be based at the Community Health Center (CSCOM) level to transport spray teams to the various villages within the radius of the CSCOM.

A major challenge in 2011 that will most likely also be a challenge in 2012 was poor road infrastructure in the target spray area, which made it difficult to access some of the villages in the three districts. In addition, the delay in start-up of operations due to both political unrest and pesticide longevity on the wall (mentioned previously) increases the risk that the onset of the rainy season during operations will further degrade roads and impede transportation and the execution of the spray program.

Last year, the use of motorcycles enabled spray equipment service technicians to access remote villages to repair failed equipment and thereby improved the efficiency of spraying. Two technicians were assigned to each district. This strategy will be employed once again in 2012.

4.1.1.4 INVENTORY TRACKING

Central warehouse storekeepers in each district will record the incoming stock and distribute the equipment and supplies to the various CSCOMs for use in the field. All materials will be subject to strict regulations, in particular, the chain-of-custody of insecticides. Warehouse storekeepers will document the boxes and the sachets they receive into a stock register and

personnel picking up or returning insecticide sachets will sign transfer of custody receipt forms to trace the sachets as they go out and empty and full sachets as they come back in.

The following list provides an overview of the staffing requirements from 2011 that we believe will be applicable in 2012.

4.1.1.5 CHALLENGES RELATED TO HUMAN RESOURCES

During the 2011 campaign, the IRS team found the community workers' level of motivation to be a challenge and enlisted the involvement of the Social Development and Integrated Economy Division to supervise community mobilization. They reduced the number of IEC mobilizers to offer a stipend for their work as a motivational incentive and morale booster.

Another challenge was incorrect data recording in the field by the operators and team leaders at the beginning of the campaign. This was mainly due to low levels of education for many spray operators and confusion about definitions of data recording terms. Spray operators in Baroueli were all new and needed additional supervision and instruction, especially in the beginning of the spray round. Additionally, many mobilizers were illiterate, which created problems collecting data despite translation efforts. In 2012, it was recommended that the IEC training manuals be simplified to ensure mobilizers understand the data recording instructions. It was also recommended that IEC activities start 2 weeks before the start of operations so as to provide time for trouble shooting in the field.

4.2 SPECIAL GEOGRAPHIC CHALLENGES IN AREAS TO BE SPRAYED

Last year, poor road infrastructure in the target spray area made it difficult to access some of the villages in the three districts, causing challenges for collection of data and supervision. To ensure that supervisors were able to supervise the spray teams and collect the data forms daily, spray operators, team leaders, and supervisors traveled together in the same vehicles. Additionally, use of motorcycles enabled pump service engineers to reach remote villages in a more timely fashion to repair failed pumps and thus improve the efficiency of spraying. Two pump technicians were assigned per district.

Mali's 2012 IRS campaign preparation is, for the first time, starting in the full rainy season. While the previous IRS campaigns (2008 – 2011) have been organized in May or June, this year's campaign will be held in July and August. This is the period of peak rainfall in Mali and will pose a large challenge, specifically the difficulty of mobilizing the population for the campaign (during a farm work period), problems with transportation due to the road state, and frequent flooding areas in Bla.

4.3 TRAINING

There are 11 different types of training that must be completed for the 2012 IRS campaign. A description of each type of training, as well as the number of days needed for each training session, is depicted in Table 6 below. This table also includes the number of people that will need to attend each training session.

TABLE 7: TRAINING TO BE PERFORMED

Training	Description	Number of Days of Training	Number of People to be Trained
Training of Trainers for Census Agents (number can change)	Since this will be the third time that census agents are used to help collect pre-spray data on the location of concessions that contain eligible structures for the IRS campaign, the training will consist of a one day "refresher" course for the trainers that will lead the Census Agent training. The course will go over strategies for collecting this data, including the eligible structure definitions stressed by AIRS Mali (see annex d, M&E Methods on page 42.)	1	68
Training of Census Agents(number can change)	As this will be a refresher for most Census agents, the training will take place over one day, most likely in Segou. The training will provide clear instructions on how to collect data on the location of concessions that have eligible spray structures, and gaining a strong understanding of the eligible structure definitions.	1	1172
Training of trainers	<p>The training will occur in Segou, and will feature presentations and participation by the NMCP, District health and environmental offices, MRTC, and AIRS Mali. Key topics that will be covered, include:</p> <ul style="list-style-type: none"> • Basic Malaria information, including epidemiology, malaria prevention, malaria transmission, and malaria treatment • Storage of IRS commodities • Safety issues concerning IRS campaigns • IEC • Spray pump use and maintenance • Spray Technique • Pesticide waste management • Data management and quality (correct use of forms) • Spotting data errors • Identifying an eligible structure • Supervising IRS teams <p>After the TOT workshop, the participants will be given a post-training test, and individual that score high enough will be selected to participate as trainers</p>	5	30

	in future IRS trainings.		
Training of Spray Campaign Personnel	<p>Training is completed at the CSCOM level. The training goes over all elements of the spray operations, with an emphasis on completing reporting forms properly. The training will include all individuals that will participate in the various roles of the IRS campaigns, During this training a pre- and post- test is conducted to select supervisors, spray team leaders, storekeepers, spray operators, washers, and guardians (for the storage facilities).</p> <p>In addition to the basic training, supervisors, team leaders and storekeepers receive orientation/training focused on their specific tasks.</p> <p>The washers and guardians will also have an orientation on their specific tasks.</p> <p>Following the training, a post training exam is given, and depending on the results, individuals are assigned as:</p> <ul style="list-style-type: none"> • Spray supervisors: 68 • Spray operators: 550 • Team Leaders: 160 • Data Clerks : 21 • Washers: 114 • Storekeepers: 68 • Guardians: 68 	5	1028 296 182
Training of Stock Managers	The district storekeepers will receive stock management and security training, and in turn, the district storekeepers will facilitate the training of secondary store Storekeepers.	1	3
Spray Pump Maintenance Training	Training will go over the parts and mechanics of the spray pumps, and best practices for maintaining and fixing the spray pumps. The IRS project has two maintenance technicians per district, that use motorcycles to travel around the spray areas and repair spray pumps as needed.	1	6
Training of Drivers	Drivers that will transport insecticide will be trained on methods and protocol for handling insecticides, what to do in-case of an emergency situation when transporting insecticides, and methods for cleaning vehicles and handling insecticide run-off	1	81
Training of Health	Health workers from local and district health centers will be trained for handling insecticide poisonings, skin	1	8

Workers and Insecticide Poison Management	irritations, and other injuries. General poison control guidance will be provided. District health centers will be designated as focal places to handle insecticide poisoning issues.		
BCC/IEC Training of Trainers	Health staff representatives for each of the health areas in Baroueli, Bla, and Koulikoro will be trained as trainers for IEC trainings. The trainers will train designated community health workers for each district to act as the IEC mobilizers.	2	68
IEC Training	The IEC Trainers will train the community health workers/IEC Mobilizers on messages and information that the IEC mobilizers will provide about the IRS activities. Additionally the trainers will go over best practices and techniques for communicating the IEC messages The training of the IEC mobilizers and the IEC messaging will be provided by the Communication department of the MOH.	2	1172
M&E and Data Clerk Training	The AIRS M&E Manager and Database Manager will train data clerks on the IRS campaign data forms, understanding of key definitions (ex. Eligible structure), spotting data errors, and data entry procedure.	2	21

4.4 OPERATIONAL SITES AND STAFF

There are 27 operational sites in the Bla district with a total of 229 spraying operators. A detailed list of the total number of staff per operational site can be found in the table below.

TABLE 8: BLA OPERATIONAL STAFF

BLA							
AIRESANTE	STRUCT	OP	CE	SUP	MAG	GARD	LING
BENGUENE	2659	7	2	1	1	1	2
BLA CENTRAL	8648	23	6	1	1	1	4
BOGONI	2083	5	2	1	1	1	1
DIARAMANA	4012	11	3	1	1	1	2
DIEDALA	1766	4	1	1	1	1	1
DIENA	3735	10	3	1	1	1	2
DOUGOUOLO	2846	7	2	1	1	1	2
FALO	5899	15	4	1	1	1	3
FANI	2971	8	2	1	1	1	2
KZANGASSO	1805	6	2	1	1	1	1
KEMENI	3115	9	3	1	1	1	2
KOULANDOUNGOU	1304	5	2	1	1	1	1
KOUTIENSO	2369	6	2	1	1	1	1
MARELA	2663	8	2	1	1	1	2
NAMPASSO	4027	11	3	1	1	1	2
NIALA	2987	8	2	1	1	1	2
NIAMANA	4364	11	3	1	1	1	2
PENESSO	1283	4	1	1	1	1	1
SAMABOGO	1633	5	2	1	1	1	1
SAMBALA	1964	5	2	1	1	1	1
SOMASSO	2944	8	2	1	1	1	2
TIENABOUGOU	2836	7	2	1	1	1	2
TONTO	4354	12	3	1	1	1	2
TOUNA	6052	18	5	1	1	1	3
YANGASSO	3601	10	3	1	1	1	2
BOUGOURA	736	2	1	1	1	1	1
TALO	1455	4	1	1	1	1	1
	84111	229	66	27	27	27	48

Key: OP = Opérateur = Operator
 CE = Chef d'équipe = Team Leader
 Sup = Supérieur = Supervisor
 MAG = Magasinier = Storekeeper
 LING= lingère = Washperson
 GAR = Gardien = Guard

In the Koulikoro District, there are 18 operational sites with a total of 138 spraying operators. A detailed list of the total number of staff per operational site can be found in the table below.

TABLE 9: OPERATIONAL STAFF IN KOULIKORO

KOULIKORO							
	STRUCT	OP	C EQ	SUP	MAG	LING	GAR
CHOLA	1825	4	1	1	1	1	1
DOUMBA	1636	4	1	1	1	1	1
GOUNI	2810	8	2	1	1	2	1
KAMANI	1875	5	2	1	1	1	1
KENENKOUN	4716	12	3	1	1	2	1
KOLEBOUGOU	3681	12	3	1	1	2	1
KOULA	2832	7	2	1	1	2	1
KOULIKOROBA	2929	11	3	1	1	2	0
MONZOMBALA	2949	7	2	1	1	2	1
NYAMINA	5739	16	4	1	1	3	1
SIRAKOROLA	5508	11	3	1	1	2	1
SIRAKOROBOUGOU	2038	5	2	1	1	1	1
SIZANI	1654	4	1	1	1	1	1
TAMANI	4099	10	3	1	1	2	1
TIENFALA	1950	5	2	1	1	1	1
TOMBOUGOU	2012	5	2	1	1	1	1
TOUGOUNI	3690	8	2	1	1	2	1
MASSALA	1507	4	1	1	1	1	1
	53450	138	39	18	18	29	17

The Barouéli District has 23 operational sites with a total of 183 spraying operators. A detailed list of the total number of staff per operational site can be found the table below.

TABLE 10: OPERATIONAL STAFF IN BAROUELI

BAROUELI							
AIRESANTE	STRUCT	OP	C EQ	SUP	MAG	LING	GAR
BANIDO	1692	5	2	1	1	1	1
BARAOUELI	10447	22	6	1	1	3	1
BOIDIE	2901	13	4	1	1	2	1
DOTEMBOUGOU	2071	5	2	1	1	1	1
DIOFORONGO	1789	2	1	1	1	1	1
DOUGOUFIE	3186	7	2	1	1	2	1
GARNA	2442	7	2	1	1	2	1
GOUENDO	3416	9	3	1	1	2	1
KALAKE	4207	9	3	1	1	2	1
KONOBOUGOU	8503	24	6	1	1	4	1
MOABOUGOU	2900	8	2	1	1	2	1
M'PEBOUGOU	1281	3	1	1	1	1	1
N'DJILLA	1416	4	1	1	1	1	1
N'GASSOLA	1970	5	2	1	1	1	1
NIANZANA	2730	6	2	1	1	1	1
SANANDO	4826	12	3	1	1	2	1
SEGUELA	2110	5	2	1	1	1	1
SOMO	3329	8	2	1	1	2	1
TAMANI	3008	10	3	1	1	2	1
TESSERELA	1851	6	2	1	1	1	1
TIGUI	1950	4	1	1	1	1	1
YEREBOUGOU	1183	4	1	1	1	1	1
WONDOBOUGOU	2087	5	2	1	1	1	1
	71295	183	55	23	23	37	23

4.4.1 RECRUITMENT

The 2011 IRS Mali project used the health system already in place in Mali rather than implementing new recruitment activities

District authorities selected spray operators within the targeted districts. Selected individuals were heads of community medical centers, mayors, and village leaders. Selected spray operators were literate and came from the area targeted for IRS

5. ENVIRONMENTAL COMPLIANCE

5.1 Environmental Health and Safety Compliance

A Supplemental Environmental Assessment (SEA) was approved by USAID in May 2008 and in July 2008; an Environmental Impact Assessment (EIA) was approved by the Ministry of Environment (MOE). In 2011, the IRS project expanded to a new district, and a revised SEA was submitted to include Barouéli.

Prior to implementation of IRS operations, there are many environmental compliance criteria that must be met to ensure correct and effective indoor residual spraying, and to minimize environmental risk. These environmental compliance activities include:

- Conduct an inspection of the environmental conformity of IRS sites (soak pits, storage rooms, etc.) before the campaign and ensure that two other inspections are carried out (one pre- and the other mid-campaign are planned);
- Ensure that an environmental mitigation and monitoring plan is adhered to during IRS campaign;
- Ensure the personal safety of the spray personnel through proper use of personal protective equipment (PPE) and compliance with standard operating procedures; and
- Ensure that the environmental and community impact during and after the IRS campaign are minimized through effective IEC and proper stock management of insecticide.

Annex A shows the mitigation and monitoring activities for the IRS program in Mali.

5.2 PRE-SPRAY INSPECTION ACTIVITIES AND FINDINGS

In order for Abt Associates to proceed with the implementation of the PMI activities in 2012 and in order to ensure the protection of the environment and human health in all areas of intervention, it is necessary to first proceed with a pre campaign inspection of the environmental compliance of spraying operations. The pre-spray inspection was originally scheduled for April 2012 and instead took place in June. This delay has resulted in the cessation of site visits to the 68 operational sites as planned. Rather, a reasoned and informed sampling of central stores and three (3) operation sites per district were inspected.

The Abt Associates team visited the health districts of Bla, Barouéli, and Koulikoro from 11 to 18 June 2012 to assess the environmental compliance of the Central stores and operation sites of the districts. Objectives of the pre-spray inspection included:

- Review the location and the physical condition of all stores for storage of insecticides and other materials used during the IRS;
- Observe the operational state of clean up and waste disposal areas (sumps, wash areas, drying area) of the IRS;
- Check the availability of the personal protection equipment and adequate cleaning equipment;
- Identify the difficulties associated with the storage of insecticides and personal protective equipment and all aspects of environmental non-compliance;
- Draw up an inspection report with the recommendations; and
- Propose a plan for problem resolution.

To complete these objectives, the inspection included a field trip to inspect the main and secondary stores, sumps, and areas of washing and/or drying; administration of the standard checklists for central stores and operation centers visited; return of the results; and a meeting to discuss logistics for the finalization of the plan for resolution of any problems identified.

The following sites were visited during the pre-spray inspection:

- **District of Bla**
 - Bla central store
 - Yangasso
 - Tiénabougou
 - Marela
- **District of Barouéli**
 - Barouéli central store
 - Tigui
 - No Djilla
 - Dotembougou
- **District of Koulikoro**
 - Store Central de Koulikoro
 - Chola
 - Monzombala
 - Tombougou

The pre-spray inspections in the three districts provided a list of findings including strong points for each operational site and areas for improvement. Using this information, a list of recommendations was created for each site. The full table of results from the pre-spray inspection can be found in Annex B.

Many challenges will be faced during the IRS campaign, including improving the condition of operational sites, and difficulties of the terrain, which were revealed during the pre-spray inspection. Some of the critical conclusions from the pre-spray inspection are summarized below:

Central District Store

- They are in good condition but are beginning to be overcrowded by housing and other establishments (Bla and Barouéli);
- The amount of space set aside for insecticides in the store is not adequate;
- Failure of the necessary personal protective equipment;
- Lack of emergency (health and environmental) management kits;
- "Skull and crossbones" posters are present, apart from Koulikoro; and
- Absence of additional stock Record of Data Security (RDS) or emergency management procedures.

Secondary Store

- In general, the situation of these stores is of concern. If they are not being used for other purposes, they are abandoned and not being cared for. Overall, the stores are in poor condition (roof, floor, portal). Many stores are near homes or animal pens. There are no hazard alert posters present.

Areas of Washing/Sumps

- Washing areas are rarely fenced and do not have locks;
- Washing areas and connecting pipes have cracks and are invaded by sand and plant debris;

The major challenge to environmental compliance for the 2012 campaign is the current political situation in Mali and the transition to a new governmental regime as well as the mitigation of the crisis in the north of the country. The political instability in the country and resulting delay in the campaign means that activities will take place during rainy season. This is the period of peak rainfall in Mali, which will pose problems in mobilizing the population for the campaign, problems with transportation, as routes between operation sites will be difficult to access in late July and August, and frequent flooding issues in flood prone areas such as Bla.

There is risk of destruction of some secondary warehouses, that are often not built with strong material (Banco). Houses in villages are often built with mud and will be subject to runoff from the roof during rainfall events. From the standpoint of human health, it will be difficult to keep children and animals away from structures and observe recommended time before the reoccupation of structures by people after spraying.

Flooding issues may also increase certain environmental hazards, such as increased risk of incidents during the transport of pesticides. Flooding can lead to the collapse of some houses after spraying, which could allow insecticide contained in/on the walls to be taken up in runoff and thus constitute a threat to nearby water ecosystems. This could also occur in washing areas and / or soak pit area that overflow during periods of heavy rains fall if measures are not taken.

The difficulties reported above can be mitigated with the implementation of the following measures:

- Inspection of all campaign operation sites (as soon as possible);
- Strengthening the safety precautions when transporting products;
- Selection of vehicles capable of negotiating flooded roads and tracks;
- Wrap all insecticides boxes with plastic sheets during transport process;
- Follow the weather forecast to avoid transportation of pesticide during storms;
- Emphasize the rainy season and the measures to be taken during drivers training;
- Strengthen awareness of households, put special emphasis on the state of houses to be sprayed: recipients should regularly review the structures roof before and after spraying to deal with any eventuality roof runoff;
- Place special emphasis on choice and repair of secondary stores;
- Provide covers for washing areas for protection against overflow caused by excessive rain;
- Strengthen measures to raise awareness of need for labor availability during spraying process;
- Provide extra plastic sheets for various needs (roof and floor coverings);
- Provide rain gear for supervisors and others actors.

5.3 OPERATIONAL SITE NEEDS

Table 10 below depicts deficiencies of the various operational sites and identifies the work that must be done prior to spray initiation to resolve these issues. Estimated execution time for the work is also included.

TABLE 11: OPERATIONAL SITE DEFICIENCIES & WORK NEEDED

Deficiencies	Proposed Solutions	Sites Affected	Time of Mission Identification and Supply of Equipment and Inputs	Time Needed for the Rehabilitation of the Structures at Each Level
Stores near houses, flooded area, animal pens	Identify new compliant stores	Yangasso, Tigui, Chola, Talo, Bougoura, Nampasso, Dougouolo, Diaramana, Tonto, Somasso, Kéméni, Sanando, central Barouéli, Koula, Sirakorola, Kolebougou	<ul style="list-style-type: none"> • 3-7 days in the District of Wheat • 2 days in the District of Barouéli • 2 days in the District of Barouéli 	2 days
Secondary stores in poor condition (roof, floor, portal...)	Rehabilitated stores	Fani, Kanzankasso, Bogoni, Niala, Niamana, Falo, Tienabougou, Diedala, Kéméni, Marela, Diena, Touna, Moabougou, Dotembou, Séguéla, Tamani, Kalake, Gouendo, Monzombala, Tombougou, Kolebougou, Gouni, Tamani, Sirakorobougou, Tougouni, Kamani, Kenenkoun, Tienfala, Chola, Sirakorola, Tienfala, Doumba, Sizani	<ul style="list-style-type: none"> • 3-7 days in the District of Wheat • 2 days in the District of Barouéli • 2 days in the District of Barouéli 	1 day
Absence/ill State of closing and the lock for washing areas and sumps	Close the range of washing and sumps and/or provide system lock	All sites	<ul style="list-style-type: none"> • 3-7 days in the District of Wheat • 2 days in the District of Barouéli • 2 days in the District of Barouéli 	2 days
Cracks at the level of connection channels and washing areas;	Rehabilitated washing area	TALO, MPenesso, Nampasso, Kanzankasso, Dougouolo Samabogo, Diaramana, Bogoni, Niala, Falo, Tienabougou, Beguene, Diedala, Kéméni, central Bla Diena, Sambala, Chola, Monzombala, Tombougou, Tienfala, Sirakorola, Sirakorobougou, Sizani, tamani, Tougouni, Massala, Koula, Kenenkou, Kamani, Gouni, Doumba	<ul style="list-style-type: none"> • 3-7 days in the District of Wheat • 2 days in the District of Barouéli • 2 days in the District of Barouéli 	1 day

Drains close to a water point or located in a flood zone	Identify a new site and build a new sump with washing area	Yangasso, Fani, Marela, Dioforongo	<ul style="list-style-type: none"> • 3-7 days in the District of Wheat • 2 days in the District of Barouéli • 2 days in the District of Barouéli 	1 day
Invasion of the washing areas and plant debris or sand drains	Clean wash areas	All sites	<ul style="list-style-type: none"> • 3-7 days in the District of Wheat • 2 days in the District of Barouéli • 2 days in the District of Barouéli 	1 day
Total			7 days	8 days

5.4 SOLID WASTE DISPOSAL

In 2010, incineration for the Koulikoro district occurred at Sinzani; and for the Bla district, at Koutienso. In 2011, PMI Mali purchased a portable incinerator, which was based in Noumoubougou. The IRS program worked with the African Program on Pesticide Stocks (*Programme Africain relatif Aux Stocks de Pesticides [PASP]*) and the MOE to dispose of all wastes collected from the inception of the IRS program using the mobile incinerator, including all the solid wastes (empty insecticide sachets and other solid waste) from the 2011 campaign in Koulikoro and Barouéli. For Bla, the insecticide sachets were destroyed using the mobile incinerator and other solids waste were sent to the facility in Koutienso. By using the mobile incinerator in Noumoubougou (Koulikoro region), Mali has shown its capacity to manage in a responsible manner the wastes produced by its IRS program. Wastes generated in the 2012 campaign will also be destroyed using this incinerator.

ANNEX A: ENVIRONMENTAL MITIGATION AND MONITORING PLAN FOR IRS PROGRAM, MALI

Negative Impact	Prevention and/or Mitigation Activities	Frequency	Program Targets	Indicators	Source of Information	Implementation Responsibility
Driver and/or community exposure, or environmental contamination due to improper transport of pesticide	<p>Driver training according to FAO manual (Annex 6)</p> <p>Provision of appropriate equipment (reliable vehicle with side walls capable of negotiating rugged roads, tie-downs, packing materials, tarps, spill clean-up kit)</p> <p>Cautious driving while transporting chemicals</p> <p>Checking for and repairing leaks from spray equipment prior to bicycle transport</p> <p>In case of accident, completion of accident and corrective action report</p>	<p>Once prior to campaign, reinforcement as needed</p> <p>Continuous</p>	<p>Drivers</p> <p>Team leaders</p> <p>Supervisors</p> <p>Health Workers</p>	<p>Procedures being followed</p> <p>Demonstrated knowledge</p> <p>Existence of training materials</p> <p>Absence of vehicle accidents</p> <p>Vehicle condition</p> <p>Absence of spills during insecticide transport</p>	<p>Training attendance records</p> <p>Audit reports, visual observation reports</p> <p>Interviews</p> <p>Vehicle inspection Reports</p> <p>Accident and corrective action reports</p>	<p>Drivers, Abt Associates, Pesticide distributors, spray team leaders</p>
Environmental Contamination due to improper siting or construction of storage and wash facilities	<p>Use site qualification checklist. Locate storage and wash facilities on high ground, above floodplains, away from sensitive receptors (water bodies, birds, bee's fish, children, etc.).</p> <p>Use appropriate construction materials as specified in FAO manual (Appendix 7).</p>	<p>Once prior to campaign</p>	<p>Program implementers</p>	<p>Storage and wash facilities outside of floodplain and away from sensitive receptors (birds, bees fish, children, etc.)</p> <p>Built with suitable materials, adequately ventilated</p> <p>Adequate space</p>	<p>Site qualification checklist, maps, inspection reports</p>	<p>District Environmental Officers, Abt Associates, Inc.,</p>

Negative Impact	Prevention and/or Mitigation Activities	Frequency	Program Targets	Indicators	Source of Information	Implementation Responsibility
<p>Storekeeper and/or community exposure or environmental contamination due to improper storage or pilferage</p> <p>Cont.</p> <p>Storekeeper and/or community exposure or environmental contamination due to improper storage or pilferage</p>	<p>Provision of secure storage facilities</p> <p>Training of storekeepers, team leaders and supervisors according to FAO manual (Annex 7)</p> <p>Daily tracking of insecticide sachets issued, used, and returned</p> <p>Storage procedures as detailed in Annex 7</p> <p>Storekeepers trained to not issue pesticides for agricultural or any other unauthorized use</p>	<p>Once prior to campaign</p> <p>Continuous</p>	<p>Storekeepers</p> <p>Team leaders</p> <p>Supervisors</p>	<p>Dedicated and trained storekeeper who demonstrates knowledge and uses correct procedures</p> <p>Stock records up-to-date</p> <p>Stocks orderly, rotation system in place</p> <p>Expiration dates observed</p> <p>Empty sachets collected, counted and reconciled with amounts issued</p> <p>Ratio of structures sprayed to sachets issued</p> <p>Storehouse temperature measured and recorded</p> <p>No leaks or spills evident</p> <p>Insecticides not stored in same room with food, or medicine, or in inhabited spaces</p> <p>Facility physically secure, padlocked and guarded when not in use</p>	<p>Training records</p> <p>Inventory records</p> <p>Waste shipment records</p> <p>Training materials contain appropriate and adequate activities and exercises</p> <p>Daily supervisor reports</p> <p>Inspection Reports</p>	<p>Storekeeper, spray team supervisors, spray team leaders, Abt Associates, Inc.</p>

Negative Impact	Prevention and/or Mitigation Activities	Frequency	Program Targets	Indicators	Source of Information	Implementation Responsibility
				No fire, flame, smoking or eating allowed in storage areas		
<p>Personnel handling OPs or carbamates experience cholinesterase inhibition (CI) due to exposure. (Symptoms include tiredness, weakness, dizziness, nausea and blurred vision, headache, sweating, tearing, drooling, vomiting, tunnel vision, and twitching, abdominal cramps, muscular tremors, staggering gait)</p>	<p>For pirimiphos-methyl (PM) and carbamates, all storage, spray, and wash, (SSW) teams receive training in recognizing effects of CI, remain alert to symptoms amongst their co-workers and respond appropriately.</p> <p>If using OPs other than pirimiphos-methyl (PM), CI testing will be performed on the SSW teams to determine base level of cholinesterase, then monitor for CI during the spray program.</p>	<p>Training: Included in pre-campaign orientation, and in training for new personnel.</p> <p>CI Testing: For OPs other than PM, once prior to the campaign and then weekly during campaign. Immediate testing upon display of symptoms.</p> <p>PM and carbamates only require CI testing if symptoms are displayed</p>	<p>SWS teams, any other personnel exposed to pesticide or residues.</p> <p>Team leaders and supervisors</p>	<p>Demonstrated knowledge of symptoms of poisoning, emergency treatment, and referral protocol by supervisors, team leaders, SWS members</p> <p>CI test results</p> <p>Antidotes available at health facilities</p>	<p>CI test results, Daily reports</p> <p>Team composition records</p>	<p>MOH, District Health Officers, Abt Associates</p>
<p>Acute effects of pesticide toxicity go untreated (Symptoms include tiredness, weakness, dizziness, nausea, blurred vision, headache, sweating, tearing, drooling, vomiting, tunnel vision, twitching, abdominal cramps, muscular tremors, staggering gait)</p>	<p>Employ CI testing as needed</p> <p>Team leaders, storekeepers trained to recognize symptoms and enforce treatment</p> <p>Ensure treatment medicines listed in Annex 4 are available at District health centers.</p> <p>If skin itches after re-entrance into home, wash with soap and water, for eye irritation, flush eyes with water.</p>	<p>Training on symptoms and responses prior to each campaign</p> <p>Continuous observation, reinforcement and enforcement of treatment protocols</p>	<p>Team leaders, supervisors, Spray operators</p> <p>First aid responders</p> <p>Store keepers</p> <p>Health center personnel</p> <p>Residents</p>	<p>Demonstrated knowledge of signs and symptoms of poisoning, emergency treatment, and referral protocol by supervisors, team leaders, storekeepers, spray operators, washpersons (SSW), and residents</p>	<p>Training records</p> <p>Observations by all parties</p> <p>Daily reports</p> <p>CI test results</p> <p>Verbal communication</p>	<p>Spray team supervisors, spray team leaders. District health officials, and Abt Associates</p>

Negative Impact	Prevention and/or Mitigation Activities	Frequency	Program Targets	Indicators	Source of Information	Implementation Responsibility
SSW member or community exposure, or environmental contamination due to equipment or PPE issues	<p>Use of sprayers manufactured and maintained according to WHOPEs specifications (Annex 6);</p> <p>Proper assembly and calibration of spray equipment</p> <p>Procurement and proper use of PPE by all persons in contact with pesticides</p>	Continuous	<p>Spray operators</p> <p>Team leaders</p> <p>Supervisors</p> <p>Storekeepers</p> <p>Wash persons</p>	<p>All PPE as specified in WHOPEs training manual (Annex 6) in good condition and worn by all personnel in contact with pesticides</p> <p>Condition of spray equipment</p> <p>Spray nozzle not dripping during spraying or transportation</p> <p>CI levels</p>	<p>Inspection reports</p> <p>Observations</p> <p>Interviews</p> <p>CI test reports</p>	<p>Spray team supervisors, spray team leaders, Abt Associates, Inc..</p>
Residential Exposure from contaminated household goods	<p>Training of spray operators to refuse to spray houses that are not properly prepared</p> <p>IEC Campaign, instruct residents to:</p> <p>Clear homes of mats or rugs, furniture, cooking implements and foodstuffs prior to spraying</p> <p>If furniture cannot be moved out of the home, then move it to the center of the room and cover with drop cloth</p> <p>Stay outside the home during spraying and for two to four hours after spraying</p> <p>Move and keep (tie-up or cage) all animals outside the home during spraying, and for</p>	<p>Training and communication program prior to campaign,</p> <p>Spray operators require household goods removal prior to spraying domicile</p>	<p>Spray operators, residents</p>	<p>IEC materials developed and include specific instructions, and delivered in appropriate fashion</p> <p>Residents outside house during spraying</p> <p>Food and goods outside house during spraying</p> <p>Furniture covered during spraying</p> <p>Residents stay outside for four hours after spraying</p> <p>Residents sweep</p>	<p>Daily reports</p> <p>Inspection Reports</p>	<p>District Environment Office, District Fisheries Office, NEMA, Abt Associates, Inc., USAID</p>

Negative Impact	Prevention and/or Mitigation Activities	Frequency	Program Targets	Indicators	Source of Information	Implementation Responsibility
	four hours after spraying Sweep up any insects killed from the spraying or any residual insecticide and drop waste in latrine pits			floor and dispose of waste properly Occurrence of skin/eye/throat irritation Houses not sprayed for lack of preparation		
Failure to realize benefits of spraying due to post-spray behavior change Cont. Failure to realize benefits of spraying due to post-spray behavior change	Train residents to continue using bed nets for protection against malaria, and to refrain from re-plastering or painting over the sprayed walls after spraying. Re-plaster prior to spraying if necessary	Prior to each campaign	Residents	Continued bed net use Walls not plastered after spraying	Query village leaders Inspection reports	Village and district leaders
Staff and community exposure in vehicle used to transport spray team and/or pesticides	Frequent washing interior and exterior of program vehicles after pesticide transport using soap and water and PPE	Continuous	Driver	Vehicle condition	Observations Verbal communications Inspection reports	Spray team supervisors, spray team leaders, Abt Associates, Inc.
SSW personnel exposure due to poor personal hygiene	Training and enforcement in good personal hygiene, daily washing of protective clothes and cleaning of equipment Prohibition of eating, drinking and smoking during travel, work or before decontamination Discipline SSW personnel that	Training once prior to campaign, continuous reinforcement and enforcement of good personal hygiene	Spray operators	Two uniforms and PPE issued to each spray operator, one set cleaned each day No eating, drinking or smoking witnessed during operations or prior	Supervisor daily reports Observations	Spray team supervisors, spray team leaders, Abt Associates, Inc.

Negative Impact	Prevention and/or Mitigation Activities	Frequency	Program Targets	Indicators	Source of Information	Implementation Responsibility
	do not follow proper procedures in all aspects of operations (handling, spraying, hygiene, cleanup)			to washing Adequate numbers of shower/bathing facilities available Shower or bath taken, face/neck and hands washed with soap and water.		
SSW personnel and/or community exposure due to poor waste management procedures	Procurement of barrels for progressive rinse, and wash-tubs for personal hygiene; inscription of equipment as District Health Office property to deter sale and domestic use in event of pilferage Collection, counting, and comparing number of empty sachets to disbursement records Collection of worn/torn gloves and masks Shipment of all wastes to authorized incinerator, destruction witnessed by Ministry of Health Official	Once prior to campaign Continuous	SSW personnel Team leaders Supervisors	Purchase records, inspection reports, waste disposal records from incinerator	Inspection reports Verbal communication Waste disposal records	District health officials, Abt Associates
Exposure of residents needing physical assistance during spray operations	Communities establish system to assist the elderly and disabled in removing self and goods from the household. Spray operators enforce removal of household goods	Train operators once prior to campaign Continuous enforcement	Disabled residents, village leaders	IEC campaign adequately addresses issues surrounding the elderly and disabled	Resident feedback, query village leaders, inspection reports	District, County, Parish, and Village leaders
Fetal/Infant Exposure due to maternal exposure	Training of stockroom, spray, and wash, (SSW) teams.	Once prior to campaign, during campaign as	Potential female SWS team members	Pregnancy test results	Medical Exam Records	Spray team supervisors, spray team leaders,

Negative Impact	Prevention and/or Mitigation Activities	Frequency	Program Targets	Indicators	Source of Information	Implementation Responsibility
<p>on spray team</p> <p>Fetal Exposure – Pregnant women in contact with pesticides</p> <p>Cont.</p> <p>Fetal/Infant Exposure due to maternal exposure on spray team</p> <p>Fetal Exposure – Pregnant women in contact with pesticides</p>	<p>Pregnancy tests as eligibility criteria for SSW teams;</p> <p>Prohibition of breastfeeding women on SSW teams;</p> <p>Education of women regarding risks of exposure</p> <p>Completion of consent forms</p> <p>Assign pregnant women to tasks that have no occupational exposure to insecticides.</p>	necessary		<p>Written confirmation from all female SWS workers that they are not breastfeeding</p> <p>Signed consent forms from all female SSW workers</p> <p>Number of females reassigned</p>	<p>Signed consent forms</p> <p>Training records</p> <p>Team leader observations</p>	District health officials, Abt Associates, Inc.
Exposure of aged, infirm, pregnant women or fetus, due to inability to leave the home during spraying	Prohibition of spraying in homes where seriously infirm or immobile persons, or pregnant women are living who cannot move outside the home <i>and</i> stay outside the home during, and 4 hours after spraying	Continuous	Spray operators	<p>Residents outside house during spraying</p> <p>Residents stay outside for four hours after spraying</p> <p>Number of houses not sprayed due to resident immobility</p>	Spray operator and supervisor daily reports	Spray team leaders and supervisors, residents, spray personnel
Pesticide contamination of water resources, (groundwater, rivers, streams, lakes)	<p>Do not spray any residences within 100 meters of water resources</p> <p>Do not dispose of any pesticides anywhere other than IRS triple rinse wash system</p>	Continuous	SSW teams, supervisors	Evidence of environmental contamination (fish, bird, or bee kills), discoloration or turbidity of water	Observations, complaints by residents, fish farmers, beekeepers, etc.	Spray team leaders, supervisors, district environmental officers, Abt Associates environmental compliance officer
Loss of biodiversity due to pesticide	Do not spray or wash near sensitive areas or critical	Continuous	SSW teams	Species die-off	Inspections, observations	Spray team leaders, supervisors, district

Negative Impact	Prevention and/or Mitigation Activities	Frequency	Program Targets	Indicators	Source of Information	Implementation Responsibility
contamination	habitat					environmental officers, Abt Associates environmental compliance officer
Farm, aquaculture or apiary contamination	<p>Train farmers, fish farmers and beekeepers in target areas to guard against contamination of agri/aquaculture or apiary equipment, and to ensure sweeping and disposal of floor residue and dead after IRS in pit latrines prior to storing equipment in home.</p> <p>Train SSW workers on the dangers of pesticides to food, fish, birds, and bees</p>	Once prior to campaign	Agri/Aquaculture and apiary practitioners in target area, SSW workers	<p>Number of post-spraying complaints from agri-aquaculture or apiary practitioners in target area</p> <p>Reports of fish or bee kills</p>	District and parish leaders, residents, spray operators, team leaders, supervisors observations and reports	Spray team leaders and supervisors, spray personnel Abt Associates, District Fisheries Office
Spray operations have no/reduced impact on vector due to pesticide quality	<p>Collect insecticide samples and test to ensure quality control</p> <p>Supervise and monitor pesticide make-up procedures</p>	<p>Periodic spot sampling</p> <p>Continuous monitoring by spray team leaders and supervisors</p>	Implementers, team leaders	<p>Pesticide meets specifications</p> <p>Spray operator usage reports reflect proper house/sachet ratio</p>	<p>NDA testing, certificate of analysis from vendor</p> <p>Spray operator daily reports</p>	Abt Associates, Inc., National Drug Authority, team leaders and supervisors
Loss of efficacy of pesticides due to continuous or inappropriate use	Use pesticide rotation or mosaicing protocol to minimize development of resistance to insecticides. Avoid agricultural use of health-based pesticides.	Continuously re-assess pesticide to be used based on entomological monitoring	Entomologist	Protocol developed	<p>Written protocol</p> <p>Resistance test results</p>	Abt Associates, Inc.

Negative Impact	Prevention and/or Mitigation Activities	Frequency	Program Targets	Indicators	Source of Information	Implementation Responsibility
Vector develops resistance to insecticide used	Change pesticide used	Monitoring resistance before, during, and after each campaign.	Entomologist	Monitoring results presented in end-of-round report	Entomologist report	Abt Associates
SSW worker or community exposure, or environmental contamination due to negligence	Take disciplinary action against SSW workers that do not follow proper procedure in all aspects of operations (handling, spraying, hygiene, cleanup) up to and including discharge from duties	Continuous monitoring throughout campaign, immediate action upon discovery of non-conformance with procedures	SSW workers, supervisors, team leaders	Good hiring and management practices Adequate supervisor to team leader to spray operator ratio Number and severity of incidents reported	Daily supervisor reports Disciplinary reports	Spray team supervisors, spray team leaders, Abt Associates, Inc., District Officials
Community exposure, or environmental contamination post-campaign due to inadequate demobilization	Spray equipment, uniforms, PPE, wash equipment, , etc. get a final cleaning at end of campaign and are securely stored Check expiration dates on all leftover pesticide. Transfer any unused pesticide to District secured warehouse for disposal if expired, or use in subsequent spray round(s).	Once at end of campaign	SSW workers team leaders supervisors	Presence of adequate facilities for end of campaign cleaning and storage Visual observance of proper demobilization All equipment cleaned and properly stored	Purchase records, end of campaign inventory, photographs, observations, supervisor reports, end of campaign reports	District health teams, Abt Associates, Inc.
Community exposure due to residuals in vehicles used for pesticide transport	End-of-program cleaning/decontamination of interior and exterior of vehicles	Once after campaign	Driver	Interiors and exteriors of vehicles cleaned	End of campaign report	Drivers/Rental company

ANNEX B: PRE-SPRAY INSPECTION FINDINGS & RECOMMENDATIONS

Site	Strong Points	Areas for Improvement	Recommendations
DISTRICT OF BLAH			
Blah Central Store	<ul style="list-style-type: none"> -wide enough for products and materials -well secured and kept 24/24 -Door with double locks and Windows screened and protected. -Pesticides properly labeled -Record of data security (RDS) available in store -Response procedures and emergency response to spills in store (with phone numbers) -Store articles sorted by category and arranged on pallets -Height of stack (2 m) maximum met -Thermometer in warehouse and statements to date -Waterproof floor roof 	<ul style="list-style-type: none"> -Presence of a secondary school near the store -Fire extinguisher placed inside but not the outside -Absence of poster "death head" on the exterior -Absence of spill management kits -Insecticides product stored in the same location as the bikes -Absence of alleys between the wall and the stored products -Insufficiency of PPE for the actors of the spray -Absence of additional RDS for vehicles <p>warehouse and vehicles</p>	<ul style="list-style-type: none"> -Negotiate with the proponent of the school for its transfer -Start the fire extinguishers between the inside and the outside of the store -Provide the store posters "death head." -Provide the store of sufficient spill of product management kits (33 necessary kit for the store and the vehicle of transport) -Supply store in additional PPE (gloves, boots, suits, masks, cover supervisors, maintainers, washers, storekeeper of site operation, external supervisors)
Yangasso		<ul style="list-style-type: none"> -Secondary store used as a training room -Store and sump of the range of washing located in a flood zone and near a body of water (at about 15 m) -Store and hardly accessible to vehicles (swamp areas) washing area -Absence of fencing for the washing area 	<ul style="list-style-type: none"> -identify a new site for the store and the washing area "-build the new site of poster death head".
Tiénabougou	- Establishment situated at a sufficient	- The lock of the door	- Rehabilitated the store and the

Site	Strong Points	Areas for Improvement	Recommendations
	<ul style="list-style-type: none"> distance of schools, houses and water - Washing areas and sump located from a body of water, a flood zone - Areas of washing without cracks and effluent easily empty 	<ul style="list-style-type: none"> - Absence of closing of the wash and Soak pit area - Absence of posters "death head", procedures of intervention of emergency and response to oil spills - Roof and floor leaking - Cracks t of debris at the level of the washing range - Is in poor condition and without locks - Absence of spill in-store management Kit - Non-functional showers 	<ul style="list-style-type: none"> washing area - Fill the site of posters "death head." - Repair the door and locks
Marela	<ul style="list-style-type: none"> - Areas of washing without cracks and effluent easily empty - Good media and rope the washing area - 	<ul style="list-style-type: none"> - Washing area and store adjacent to a pastoral well (25 m of the sump) - Absence of fencing the area for washing and sump - Roof and floor leaking (presence of flow of water from the floor) - Presence of place animals near the store - Non-functional showers 	<ul style="list-style-type: none"> -Transfer the washing area to a consistent site (urgent and imminent) -Identify another site for the store, failing to strengthen the security measures around the store (close and rehabilitate the store, evacuated animal pens)
DISTRICT OF BAROUELI			
Barouéli Central Store	<ul style="list-style-type: none"> -wide enough for products and material -Door with double locks and Windows screened and armored -Store well ventilated and sufficiently informed -Pesticides properly labeled -Record of data security (RDS) available in store -Presence of 24 first aid Kit -Response procedures and emergency 	<ul style="list-style-type: none"> -Store located near a House with animals -Storage of products and material: difficult movement between sections, insecticidal products stored in a cramped compartment -Fire extinguisher not hung on the wall of the store (deposited in the Office of the storekeeper) -Extinguishers without pressure (pressure gauge at zero) -Absence of poster "death head" on the exterior facade -Absence of spill management kits -Insufficiency of PPE for the actors of the spray (players such as seamstresses, pump repairers, drivers were not 	<ul style="list-style-type: none"> -strengthen security around the store with a fence -increase awareness near housing as to the danger of the products -redevelop the store storage plan offering sufficient space to insecticides products -Doing the maintenance of fire extinguishers -Provide the store of enough sheets of safety and hazard alert posters "death head."

Site	Strong Points	Areas for Improvement	Recommendations
	<ul style="list-style-type: none"> response to oil spills in store (with phone numbers) -Store articles sorted by category and arranged on pallets -Height of 2 m maximum respected stack -Thermometer in warehouse and identified day temperature -Floor and waterproof roof 	<ul style="list-style-type: none"> included in the PPE available) -Absence of additional RDS for transport vehicles 	<ul style="list-style-type: none"> -Provide additional PPE store to cover the actors during the campaign - Supply the center of Kits pregnancy tests (the former stock being outdated)
No Djilla	<ul style="list-style-type: none"> - Store and washing area at a sufficient distance of schools, houses and water - Range closed washing - Good media and cordage of the area - Showers in good condition 	<ul style="list-style-type: none"> - Failure in the locking of the store portal system - Absence of portal for the washing area - washing and sump - Absence of poster of danger with "head of death." - Presence of plant debris and sand on the "Soak pit." - The non-watertight store floor - Presence of cracks on the surface of washing - Closing of the washing range without displays of danger "head of death." 	<ul style="list-style-type: none"> - Provide locks store Portal - Build the fence of the portal with locks washing range - Fill the site of posters of danger with "head of death." - Repairs to the roof of the store and cement floor - Rehabilitated area of washing with a layer of mortar - Clean the sump - Rehabilitated the washing area and build a fence
Dotembougou	<ul style="list-style-type: none"> - Establishment situated at a sufficient distance of schools, houses and water points - Washing areas and sump located from a body of water, a flood zone - Lack of plant debris and sand drains - Good media and rope the washing area 	<ul style="list-style-type: none"> - The store collapsed roof and floor non-watertight - Door of the store without lock - Intervention procedure of emergency and response to e non-displayed spills in-store to the store - Washing areas and non-closed sumps - Washing area shows cracks - Shower without closing and non-functional 	<ul style="list-style-type: none"> - Repair the roof of the store, the floor and washing area - Equip the door of the lock store - Provide the range of closing with door lock wash - Rebuild the shower
Tigui	<ul style="list-style-type: none"> - Store in good condition and with a 	<ul style="list-style-type: none"> - Store close to the maternity health center (about 20 m) 	<ul style="list-style-type: none"> - Identify a new store for the

Site	Strong Points	Areas for Improvement	Recommendations
	<ul style="list-style-type: none"> lock - Roof of the store in sheet waterproof - Floor of the well smooth and tight - Presence of fence around the washing area and sump 	<ul style="list-style-type: none"> - Presence of plant debris and sand the sumps - Presence of cracks on the materials and rope the washing area - Closing of the washing range has no door 	<ul style="list-style-type: none"> storage of products in accordance with - Repair the washing area and the coupling device - Clean the sump - Strengthen the closing of the washing area and equip it with a door to lock
<p>Central Store of Koulikoro</p>	<ul style="list-style-type: none"> - Store at a sufficient distance of schools, houses and water - Double lock on the portal of the store of insecticides - Floor of the waterproof store - Store properly informed and provide ventilation system - Establishment monitored 24 hours per day - Windows screened and protected - Presence of posters to alert of danger with head of death and bones - Guards have boots, whistles and the flashlights - Pesticides properly labeled - Available at the store and posted safety (MSDS) data sheet - Aid for transport vehicles and fully supplied warehouse kits - Response procedures for emergencies and emergency 	<ul style="list-style-type: none"> - Ramp access to the store in poor condition - A fan of the store down - Lack of toilets and source of water for the store - Absence of additional RDS for transport vehicles - Roof of the store drop by location in the long rain - The guardian of night does not phone - The current storage of insecticidal products does not allow free circulation for the control of stocks (congestion by free wood pallets) - Absence of RDS and additional emergency response procedures for vehicles of insecticide - Lack of PPE including suits and masks for the opening of the needs of the players in the campaign - The available boots are for the most part small (size 7) - Absence of operators of incineration gas mask 	<ul style="list-style-type: none"> - Repair the ramp to the store - Give the store a toilet and a water source - Fix the fan failure - Fill the store extra RDS and procedures for emergency transport vehicle management - Repairs to the roof of the store - Provide the guardian of night of mobile phone or fill the store to a fixed phone - Rearranging the store storage plan to allow a free movement of the inspectors on the insecticidal products - Fill the store combinations and additional masks - Supply the center of Kit pregnancy tests (the former stock being outdated) - Organize an exchange of boots with Barouéli store which has boots large sizes in excess

Site	Strong Points	Areas for Improvement	Recommendations
	<p>management in store (with phone numbers)</p> <ul style="list-style-type: none"> - Containers for waste available and clearly identified - Sections of the store sorted by category and arranged on pallets - Height of stack (2 m) maximum respected and gone available - Thermometer in warehouse and found day temperature - Spill of insecticides Management Kit available at the store - The Interior and exterior fire extinguisher - Good stock sheets 		<ul style="list-style-type: none"> - Fill the store of six (6) for operators of incineration gas masks
Tombougou	<ul style="list-style-type: none"> - Store and range of washing at a sufficient distance of schools, houses and water - Door of the store with a lock - Non-functional bathroom 	<ul style="list-style-type: none"> - Roof of the store in poor condition and flow water of rain in the store - Floor completely wet and non-watertight - Absence of poster "head of death" on the store - Areas of washing device of connection to the sump have cracks - Sumps devoid of plant debris and of sand Areas of washing and sumps not closed 	<ul style="list-style-type: none"> - Repairs to the roof of the store - Fill the floor with a barrier layer - Repair the washing area and the connection - Clean the sump - Fencing the perimeter of air washing and sump
Chola	<ul style="list-style-type: none"> - Door of the store provide a lock and window screen - Areas of washing located from a point of water or a flood zone - Lack of plant debris and sand drains - Good media and rope the washing 	<ul style="list-style-type: none"> - Located store houses and side of place for animals - Absence of closing the area of washing and sump with - Non-functional bathroom - Cracks the washing area - Absence of poster "head of death." 	<ul style="list-style-type: none"> - Identify or build another store - Rehabilitated area of washing and cleaning sump

Site	Strong Points	Areas for Improvement	Recommendations
	area	Plant debris on the sump	
Monzombala	<ul style="list-style-type: none"> - Store and washing area located a sufficient distance to schools, houses and water or flood zone - Washing areas and sump located from a body of water, a flood zone - Washing well fenced with wire mesh and quilted wooden range 	<ul style="list-style-type: none"> - Floor and roof of the non-watertight store - Door of the store in poor condition - Intervention procedure of emergency and spill absent of the store management - Coupling device and washing areas have cracks - presence of plant debris and sand on the sump - Non-functional showers 	<ul style="list-style-type: none"> - Repairs to the roof of the store and if necessary coat the floor with a barrier layer - Repair the door of the store area - Rehabilitated area of washing and cleaning sump - Rebuild the toilet

ANNEX C: HEALTH AND ENVIRONMENTAL EFFECTS OF BENDIOCARB

The health effects of bendiocarb are described briefly below. Additional details are provided in Appendix B of the IVM PEA Report.

Table 1.

Insecticide	Health Effects
Bendiocarb	Bendiocarb is a broad-spectrum carbamate insecticide. Bendiocarb exhibits its toxic effects through reversible cholinesterase inhibition and is considered moderately toxic in mammals. In humans, symptoms of bendiocarb toxicity include excessive sweating, salivation, headache, blurred vision, nausea, vomiting, stomach pain, giddiness, slurred speech, tightness in the chest, and muscular twitching. The effects of chronic bendiocarb exposure have not been well documented in humans. In the RED Fact Sheet for bendiocarb, EPA reported that for most of the residential scenarios, including exposure to treated surfaces, there were risks of concern for children and adults. Additionally, bendiocarb is not expected to have reproductive effects in humans at the expected exposure levels. It has not been shown to be mutagenic in animals. EPA has classified bendiocarb as “non-carcinogenic to humans.”

The environmental behavior of bendiocarb. Additional details are provided in Appendix B Pesticide Profiles of the IVM PEA Report.

Table 2.

Insecticide	Environmental Effects
Bendiocarb	Bendiocarb is a broad-spectrum carbamate insecticide used to control a wide variety of nuisance and disease-vector insects (such as mosquitoes and agricultural insects) and to treat seeds. All registrations for products containing bendiocarb were voluntarily cancelled in 1999. Sales of existing products were allowed until April 2003, and the presence of bendiocarb in or on processed food and animal feed was allowed until April 2005. When applied to plants, bendiocarb enters the soil both directly and indirectly. In soil, bendiocarb is moderately to very highly mobile. The major fate processes are hydrolysis (in moist soils) and biodegradation. Volatilization is not an important fate process in either moist or dry soils. Biodegradation of bendiocarb is expected to be rapid. Photolysis is important in the photodegradation of bendiocarb in soil. Bendiocarb degrades prior to leaching through soil and its degradation products remain in the upper layers of soil in low concentrations. It is unlikely that bendiocarb will move through soil to groundwater or to surface water through runoff. Bendiocarb is of low persistence in soil. Water is an important factor in the transport of bendiocarb. However, bendiocarb is of limited hazard in water due to its rapid decomposition under aqueous conditions. In water, bendiocarb is not expected to adsorb to suspended soils and sediments. The major fate processes in water are hydrolysis and biodegradation; volatilization is unimportant. Additionally, direct photolysis is not a major degradative pathway in water and is dependent on the turbidity of the water. In alkaline and neutral environments, hydrolysis is expected to be a major fate process. Bendiocarb does not accumulate in water and, based on soil studies, biodegradation in water is expected to be rapid. Because bendiocarb degrades rapidly in water, bioconcentration in fish is unlikely.

