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INDOOR RESIDUAL SPRAYING
FOR MALARIA CONTROL

Malawi End of Spray Round Report

Indoor Residual Spraying (IRS) for Malaria Control
Indefinite Quantity Contract (IQC) Task Order 1

Contract GHN-I-01-06-00002-00

Prepared for:
United States Agency for International Development

Prepared by:
RTI International
3040 Cornwallis Road
Post Office Box 12194
Research Triangle Park, NC 27709-2194

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Acronyms

ACT	artemisinin-based combination therapy
BCC	behavior change communication
CDC	Centers for Disease Control and Prevention
CFR	Code of Federal Regulations
COP	chief of party
CS	capsule suspension
DAMT	ddistrict assembly management team
DCGL	Dwangwa Cane Growers Limited
DHMT	district health management team
EA	environmental assessment
GOM	Government of Malawi
HAS	health surveillance assistant
IEC	information, education, and communication
IRS	Indoor residual spraying
JCE	Junior Certificate of Education
MOH	Ministry of Health
NMCP	National Malaria Control Program
PERSUAP	Pesticide Evaluation Report and Safer Use Action Plan
PMI	President's Malaria Initiative
PPE	personal protective equipment
RTI	RTI International
SEA	supplemental environmental assessment
SP	sulfadoxine pyrimethamine
STTA	short term technical assistance
TOT	training of trainers
US	United States
USAID	United States' Agency for International Development
WHO	World Health Organization

Country Background

Malawi was identified by USAID as one of the third wave of countries to receive funding under the United States' (U.S.) President's Malaria Initiative (PMI). The U.S. Agency for International Development (USAID) and the Malawi National Malaria Control Program (NMCP) identified Nkhotakota district as a pilot district to assess operational feasibility for indoor residual spraying (IRS) activities. RTI was tasked with providing strategic, technical, management and operational support for IRS activities in Nkhotakota. In addition, PMI is strengthening entomological monitoring and sustainable use of LLINs in collaboration with RTI, the Centers for Disease Control and Prevention (CDC) Atlanta, Global Fund, local partners and other governmental organizations in an effort to strengthen the integrated vector control within the country.

In 2008, RTI and the NMCP aimed to treat at least 26,000 structures with residual insecticide in Northern part of Nkhotakota district as a pilot site. It was expected to protect approximately 85 percent of households and at least 77 percent of the total estimated target population.

This report it presents the overall operational and technical context in which the second round of IRS was executed, the outcome, and recommendations for future rounds.

IRS Round Two

Background

Malaria Transmission and Burden

Malawi is a land-locked country in southern Africa with an estimated population of 13.6 million people. It is one of the poorest countries in the world with a gross domestic product per capita estimated at $600 per year. In 2007, the life expectancy was approximately 43 years. Malaria is a major public and economic problem in Malawi; it is a disease that affects the poorest and keeps them poor. Adult lose an average of 25 working days per year to malaria, which results in significant lose of household income. In addition, the cost of treatment can easily overwhelm family resources in Malawi where low-income families spend an estimated 28 percent of their yearly income to treat malaria. Children under five, pregnant women and those living with HIV/AIDS represent the most at-risk population for malaria-related morbidity and mortality. Malarial anemia is estimated to be responsible for about 40 percent of all under-five hospitalizations and 30 percent of all hospital deaths in under-five children. Malaria is the leading cause of mortality and morbidity in Malawi, accounting for 33.2 percent of all outpatient visits.

National Malaria Strategy

In response to the World Health Organization's (WHO's) Global Malaria Program, Malawi has recently embarked on a new malaria policy with three main principal interventions accompanied by supportive strategies such as effective communication, management, coordination and implementation, operational research, monitoring and evaluation:

- Disease management: correct and appropriate case management with artemisinin-based combination therapies (ACTs) as a first line treatment;
- Prevention of malaria in pregnancy with the use of sulfadoxine pyrimethamine (SP); and
- Integrated vector control activities stressing the need for LLINs and supplemented by IRS.

District Selection

The southern part of Nkhotakota district is situated much like a geographical island, with its northern border on the Kaombe river and on the southern side, Nkhatabay district with Dwambazi river. The district borders the Nkhotakota game reserve on the east and Lake Malawi on the west. This well defined geographical area makes Nkhotakota a district in which IRS is technically sound and can be smoothly executed and evaluated. With its high malaria transmission throughout the year and IRS rounds having been carried out previously, it was determined to be the best pilot district for PMI-supported IRS.

Preparation for IRS

In August 2008, Dr. John Chimumbwa, IRS Deputy Program Director, and Jake O'Sullivan, Malawi Home Office Technical Manager at the time, traveled to Malawi to begin preparations for the second round of IRS. They met with NMCP to discuss lessons learned from the first round and challenges faced in the intervention area of Nkhotakota. They also reviewed community perception and response to IRS, the positive impact of IRS as shown by survey data on anaemia in children under 5, and way forward for IRS in the intervention district. Presentations were made by the IRS project, PMI, NMCP, the Nkhotakota District Health Office, and Illovo Sugar Estate. During the meeting, it was agreed to improve geographical reconnaissance within the spray area, improve advocacy with adequate reference to IEC materials, plan ample time for preparation prior to spraying, supplement mitigation measures to better comply with environmental standards, and divide responsibilities between the partners for improved sustainability and success of IRS.

Other planning meetings resulted in the naming of the national IRS technical committee, the national information, education, and communication (IEC)/behavior change communication (BCC) committee, a logistic and supply committee, a training committee, and a community sensitization committee. The national IRS committee was composed of eight members from the Government of Malawi (GOM) and nongovernmental organizations, including the MOH, Ministry of Environmental Affairs, the District Assembly, the Illovo Sugar Company, and representatives from the agricultural sector. The main role of the committee was to oversee the implementation of IRS operations. Three committee meetings were held before, and two during, spray operations.

Insecticide Selection

Stakeholders planning meetings held prior to the first round considered the choice of insecticide to be used for the IRS. Taking into account baseline entomological information on mosquito susceptibility, low toxicity to humans and animals, and adequate persistence on treated surfaces to be effective as a residual insecticide, pyrethroids were chosen as the preferred class of insecticides for use in IRS in Malawi. This round, the insecticide was competed at the class level and lamdacyhalothrine (ICON 10% SC) was selected based on the following factors:

- registration of the product in Malawi;
- price of the product;
- production and delivery time of the product; and
- compliance with USAID regulations.

Logistics Needs Assessment

Before the first round of spraying, the IRS project supported by CDC and the MOH conducted a comprehensive logistics assessment examining the whole range of resources required for the IRS exercise including financial, human, commodity, and operational. A supplemental logistics assessment was conducted prior to the second round of spraying to incorporate the results of the geographical reconnaissance and to take into account the balance of the commodities available in the warehouse. The assessment revealed a deficiency of some items which were later procured

(see below table). Seventeen additional Hudson Pumps were borrowed from the NMCP to supplement the requirement.

Figure 2. Material Inputs.

Item	Quantity procured
Sachets of ICON 10% Capsule Suspension (CS)	24,000
Fire extinguishers	1
Pairs of black gloves	3
Goggles	44
Boxes of service parts	10
Face masks	1200
First-aid kits	13
Rolls of black plastic sheeting	3
Visors	140
Ruck sacks/bags	151
Pieces of cloth	34

Geographical reconnaissance was executed by health surveillance assistants (HSAs) between September 18 and 30, 2008. A total of 124 HSAs were involved in the exercise and to ensure data quality, site managers provided supervision. The total number of structures and inhabitants was collected, as was distance to the health centre and location of each structure. However, owing to time constraints, other parameters like the surface area, roofing/building materials, water source, and mapping were not updated from the information collected during the first round. The outcome of the exercise was that 27,668 structures were found in the target area, including the Illovo Sugar Estate.

In early October, one week prior to the start of spraying, the IRS team contacted Illovo to retrieve the remaining insecticide from the previous round that had been stored in their facilities. Subsequent follow-up revealed that 867 sachets of insecticide were missing from the 24-hour guarded storage facility. While two storage facility guards were arrested, arraigned and later released, the case remains open without final resolution. Outside the police investigation, the IRS team conducted its own investigation, looking at every possible site, stores and other places where the insecticide could have landed or clandestinely sold, however without conclusive information. RTI has officially requested that Illovo reimburses the IRS project for the full cost of missing insecticides, which they will do so, once police investigation is closed.

Training

Training of Trainers

Training of trainers was not formally conducted this round. However, a meeting was held from September 8 to 11, 2008 during which eight participants from the district assembly, Illovo Sugar Estate, the Ministry of Environmental Affairs, the Pesticide Control Board, the farmers' organization and Syngenta received refresher training on spray techniques and supervision. The

meeting outputs were strengthening of training on practical spraying techniques, adherence to mitigation measures in compliance with environmental protection recommendations, data collection, and continuous and strong supervision and monitoring.

Spray Operator Recruitment and Training

The district assembly management team (DAMT) initiated the recruitment of spray operators in early September 2008. The advertisement was done through the 21 local radio announcements and 45 posters placed in health centres and 15 busy public places like markets, supermarkets, and community halls. The advertisement stipulated the following criteria for spray operator selection:

- Junior Certificate of Education (JCE) qualification
- Resident of the spray area
- Able to read and write in English and local language
- Able to work Monday to Saturday on a full time basis in the field
- Physically fit
- For women, not pregnant or intending to become pregnant during the exercise
- For women, not breastfeeding.

A total of 2,401 applications were received. Due to a large number of applications, the management decided to consider only those who participated in the previous spray round. One hundred ninety five (195) old spray operators took a theory aptitude test and 153 passed. The 153 successful applicants were further trained and subjected to another entry test consisting of 40 percent theory and 60 percent practical marks. A total of 143 passed the second text. As 140 spray operators were estimated to be necessary to complete spray operations, 140 of the remaining applicants were recruited and 10 were kept on standby. Out of the 140 recruits, 23 were selected for team leader's role. Of the final successful applicants, 85 were male and 55 were female.

Intensive refresher training was conducted for five days from September 22 to 27, 2008. The first group of 80 spray operators and 5 warehouse staff (who participated in all sessions except the spraying techniques) were trained in both theoretical and practical aspects of IRS by four expert facilitators. The following topics were covered: introduction to malariology, national malaria policy and framework, introduction to indoor residual spraying, personal protection, safety of the population, safety of the environment, preparing the household for IRS, emergency preparedness, choice of insecticide, introduction to IRS equipments, introduction to the spraying surface, IEC for the community mobilization, IRS pro-forma, spraying techniques, supervision in IRS, and logistics and stores management. Additionally, all operational problems encountered during the first round were discussed to find appropriate solutions. Community concerns were considered, elaborated, and thoroughly discussed by the committee to enable the team to respond appropriately to the community. The practical portion of the training covered spraying technique as per WHO guidelines. The participants' knowledge and skills were assessed by a physical demonstration of handling and operating spray pumps and filling in operational spraying forms.

An additional two day training session for both teams was conducted on October 10 and 11, 2008 to refresh the team on special issues like progressive rinsing, environmental compliance

measures, dealing with emergency situations, and collecting household information and completing spray cards.

Spray operators are instructed by trainers during a practical session.

A separate training for supervisors was conducted on October 13, 2008 to ensure effective monitoring of the program and problem solving in response to issues that might be encountered. Among the topics included were effective communication skills, leadership skills, and crisis management. A total of nine team supervisors were recruited from the HSAs from the respective health centers rather than from among the spray operators as was done in the first round. During the first round, some of the supervisors lacked accountability and leadership skills and were unable to address community misconceptions. They also failed to properly and effectively handle issues as they arose. Senior HSAs were determined to be more suitable for spray operation supervision in the second round.

Prior to spray operations, one spray operator candidate was found medically unfit to participate in spray operations and was assigned light office work.

In an effort to build local capacity to conduct a successful IRS program, ten environmental officers from malaria endemic districts attended a total of 12 days of training, including both rounds of spray operator training. They also observed and participated in the spray exercise itself to prepare them for future extensions of the campaign within their districts.

Other Training

Five warehouse staff from the previous round were trained and certified as warehouse staff for the second round of IRS.

The rest of the support staff were chosen from among the applicants, with preference being given to those with previous IRS experience. As a result, the time required for training of auxiliary

staff was reduced because only refresher training was required. Refresher training included information on environmental and human exposure mitigation measures and the appropriate actions to take in case of an accident.

Figure 5. Training for IRS.

Position	Male	Female	Total
Site managers	2	0	2
Supervisors	9	0	9
Team leaders	23	0	23
Spray operators	85	55	140
Representatives of other districts	8	2	10
Warehouse staff	5	0	5
Chiefs and village volunteers	??	??	703
Mobilizers (HSAs)	125	0	125
Peace Corps volunteers	2	0	2
Clinicians	19	5	24
Data entry clerks	1	1	2
Accounts clerk	1	0	1
Washers	2	5	7
Guards	4	0	4
Cleaner	0	1	1

Additionally, 24 clinicians representing each health facility in the intervention area and the Nkhotakota district hospital were trained on the management of pesticide poisoning.

IEC Activities and Community Mobilization

The core principle of IEC and community mobilization for IRS is to disseminate appropriate information to the community to raise awareness on malaria transmission, the benefits of IRS, and necessary household preparations, increasing community acceptance of the intervention and improving spray coverage. To ensure high coverage and the proper preparation of households before spraying and to avoid human or environmental exposure to insecticides, a new approach was used for the dissemination of information at community level. Community mobilizers were supported by chiefs and village volunteers who were recruited and trained on how to deliver information to the community one or two days before spraying using the community crier approach with a megaphone. Additionally, mobilizers went door to door to inform beneficiary households about IRS. Community volunteers varied in number between one and two per community depending on the size of the village and number of households to be sprayed.

Training of IEC Mobilizers

A three day training course for 125 HSAs from the MOH on BCC was conducted at Dwangwa Cane Growers Limited (DCGL). The trainees were divided in two groups; the first group training was conducted from September 15 to 17 and the second from September 18 to 20, 2008. Common misconceptions about IRS and community concerns were discussed in detail. The mobilizers were taught to explain to the community the purpose of IRS, preparation of the households and what to do before, during, and after IRS, and how to handle incidents if they should occur.

In an effort to meet the objective of community involvement and to maximize community acceptance of the intervention, a community-based approach was to disseminate information at the community level. A total of 703 chiefs and village volunteers (representatives from the 503 targeted villages) attended one day training in their respective centers from September 25 to 27, 2008. The training equipped the participants with basic knowledge on the negative impacts of malaria within the community and the importance and benefits of IRS as an effective malaria control intervention and enabled them to deliver appropriate information to the community. This crucial activity was conducted in local native language (Chichewa) to maximize the participants' understanding

IEC Activities

An IEC/BCC committee was developed during the preparatory phase for IRS and was composed of 11 members including sectorial supervisors from nine health catchment areas. The committee was responsible for ensuring that all appropriate and useful information on IRS reached the targeted audiences through national and private media in the district.

IEC activities began on September 18, 2008, after the first group of mobilizers completed their training. Although the most intensive and critical part of mobilization was house to house approach, a number of IEC activities were utilized to maximize spray coverage, as described below:

- Use of radio. Local radio service conveyed IRS information at least three times a day from September 18 to the end of the program on November 28, 2008. In total, 216 jingles and radio slots were aired.
- Production and distribution of IRS learning materials. A total of 10,000 leaflets were printed and distributed to the communities during the mobilization and at the actual time of spraying. The IEC leaflets were printed in the local native language (Chichewa). In addition to the leaflets, two banners were hanged along the M5 road at Nkhotakota Boma and Dwangwa at the entrance to the spray area.
- Community criers using megaphones.
- Community meetings with influential leaders within the respective villages, including chiefs, school teachers, religious leaders, political leaders, etc.

The IEC messages delivered to the community focused on the importance of IRS as an effective malaria control intervention and safety measures associated with the use of insecticides. The messages also covered the preparation of houses before and after spraying. Beneficiaries were instructed to remove all food, water, and household items from the home and to pull to the center of the room and cover heavy furniture which could not be removed. They were told to remain

outside for not less than two and a half hours, clean the floors upon reentry and bury or burn all dead insects, and to wash immediately with soap any affected area in case of contact with the insecticide and report to the spraying team or nearby health facility for serious reactions. In order to prolong the residual effects of insecticide on the walls, household members were advised not to wash, paint, or plaster the sprayed walls.

Coordination with Spray Operations

Door to door visits were conducted by the mobilizers (including village volunteers) at least two days prior to the spraying day to reinforce awareness and ensure that the community received adequate information for the proper preparation of their households. On the actual spray day, operators verified if the household owners understood the information and if the households were well prepared. After the spray, the spray operators repeated the post-spray messages and distributed a leaflet to the owners for quick reference.

Verification of the number of structures in each household was partially executed during the door to door campaign strategy. This exercise also documented the household owners in the forms which were provided. This verification helped to ascertain the actual number of households and eligible structures for data accuracy and management.

Implementation of IRS Activities

The official launching ceremony for IRS featured a local drama group and band performance who disseminated IRS IEC messages. The Nkhotakota District Commissioner launched the program having the senior chief's house sprayed.

Spray operations began on October 16 and lasted through November 28, 2008. A total of 23 teams were involved in the campaign. Each team comprised of 5 spray operators and a team leader. Each team leader reported to a supervisor who supervised two or three teams. Teams were divided into two groups: Dwangwa zone with a total of 17 teams and Dwambazi zone with a total of 6 teams. Each zone had its own site manager.

Supervisors, team leaders and spray operators were responsible for preparing sprayers and insecticide and recording forms, household spray cards and household stickers on a daily basis. The team dressed in PPE at the operation site and then traveled to the target area to meet with community leaders (volunteers and village head men) for spraying arrangements. The spraying operators were allocated to different parts of the villages and accompanied by selected community members.

Each spray operator was expected to spray a minimum of 6 households a day. When the operator reached a house, in most cases the occupants were already prepared for the spraying following the readiness messages. The residual insecticide, ICON 10% CS, was then applied to all sprayable surfaces at a dose of 0.02gm/m^2 to 0.03gm/m^2.

Spraying in Illovo Estate

During the first round of IRS, spraying in Illovo Estate was executed by its own spray operators with 2,000 sachets of ICON provided by the IRS project. However, following the theft of insecticide sachets from Illovo's warehouse and an assessment of the measures taken by Illovo to comply with environmental standards, the IRS project was not satisfied with the mitigation measures taken by Illovo spray management, particularly in regards to rinsing sites, soak pits, availability of spray gear, and insecticide chain-of-custody tracking. As a result, spraying in Illovo Estate was conducted by PMI-supported spray operators under the guidance of the Illovo spray team. Although the number of structures found in the field was considerably less than the estimates provided by Illovo management, spray coverage on the Estate was high.

Monitoring and Supervision

The immediate supervision at field site was done by team leaders and supervisors, who ensure the spraying quality and efficiency of the exercise. At the end of each day, they prepared and summarized a report of the entire spray team's progress and submitted it to the site manager. The team leaders and supervisors also monitored the groups' working discipline and solved emerging technical or operational problems in both the community and the spray teams. Operations were also monitored by the site mangers from both operating zones with support from the MOH's national IRS coordinator with continuous and active support from the IRS project's Acting Chief of Party (COP).

Furthermore, the project was supported by a number of short term technical assistance (STTA) visits to conduct monitoring from Environmental Compliance and Inspections, and Logistics Management Assistance.

Logistics

Transportation

Vehicle quotations were solicited via three days of advertisements on local community radio in Nkhotakota. Vehicles were selected based on the mechanical status of the vehicle and vehicle registration with the appropriate authorities. Drivers were tested for competency and experience and their licences verified for validity. A total of 12 vehicles were hired to support spray operations, mostly to transport spraying teams and equipment from warehouses to operational areas. In addition, one extra four by four (4x4) vehicle was hired for field supervision and seven motorbikes were borrowed from the district assembly for team supervisors to conduct monitoring and supervision.

Plastic sheet were laid down in the vehicles to prevent spillage and drivers were given gloves, soaps and gallons of water in case of an accident and were observed throughout the exercise to ensure compliance with safe driving regulations. First-aid kits were placed in each vehicle and taken to the field in case of accident. Packages of insecticides were checked for leakages and to ensure that they were not damaged during loading and unloading.

Storage

The warehouse owned by Dwangwa Cane Growers was rehabilitated to comply with standard IRS protocols for safely storing insecticides. The equipment and supplies stored in the warehouse included insecticides, sprayers and spare parts, PPE, and other accessories. All spray equipment and supplies including insecticides were recorded in the ledger book.

All equipment and supplies were issued to operators in compliance with standard storage procedures and consistent with the Pesticide Evaluation Report and Safer Use Action Plan (PERSUAP). The facilities were guarded 24 hours a day by security guards and double locks that required two storekeepers to be present for access to the store. The storage management staff was trained in the mitigation measures required in the warehouse to prevent hazardous risks, pilferage, good handling practices of pesticides and environmental compliance.

Health and Environmental Safety

A detailed environmental compliance inspection is an important component of IRS to ensure the safety of humans and the environment. As such, intensive precautions were taken to ensure that standard environmental compliance protocols were met. The first inspection was conducted during the planning stage by Gaspard Bikwemu, Senior Environmental Specialist and again during the actual spraying exercise. The output of the inspection, including the measures recommended from the first round's inspection, generated the following preparatory environmental safety measures in accordance with WHO and FAO standards:

- Construction of soak pits in Dwambazi, Dwangwa, and Lupachi
- Renovation of temporary warehouse in Dwambazi
- IEC campaign to raise community awareness about environmental and human health safety measures
- Training of 24 clinicians on the recognition and treatment of pyrethroid poisoning
- Procurement of medicines for pyrethroid exposure and first-aid kits for field teams
- Training of 12 drivers on compliance with traffic regulations and environmental and human health safety measures
- Inspection of vehicles used for insecticide transportation and provision of nitrile rubber gloves and soap, water, sand, and a bucket to the drivers in case of spillage in the field
- Procurement of PPE for all staff including washers
- Storekeeper training
- Procurement of and performance of pregnancy tests for 55 female spray operators and five washers
- Training of spray operators and supervisors on environmental and human health safety measures.

To ensure the safety of the spray teams, beneficiaries, and the environment, all recommended mitigation measures required for the environmental compliance were implemented and monitored throughout the exercise, including:

- Daily supervision by supervisors
- Provision of full sets of PPE to all spray operators, team leaders and supervisors and monitoring to ensure that they were properly worn

- Daily collection of empty sachets and recordkeeping
- Daily progressive rinsing of sprayers
- Sprayer maintenance
- Provision of bath soap to spray team and monitoring to ensure personal washing at the end of the day
- Daily laundering of overalls
- Daily collection of laundry water and rinse water for recycling
- Secure storage of all insecticides and empty packaging in storage facilities (double-padlocking, guarding)
- Provision of a drop cloth to the spray operators to cover household furniture or immovable items
- Provision of rucksacks to the spraying team to keep the data collection forms and prevent their impregnation by insecticide.

The following tables summarize the measures taken to maximize worker, resident, and environmental safety.

Figure 6. Environmental safety measures.

Objective	**Action taken**	**Indicator**
Keep insecticide at prescribed temperature	Store keepers trained and temperature recorded	Daily temperature
Avoid leaks and spills	Regular check-up of facilities/equipments	Stock orderly, no leaks or spills evident
	Train storekeepers, drivers and spray operators	
Eliminate potential exposure scenarios	Insecticide stored separate from food	Insecticide stored separate from food
Keep accurate records of insecticide use	Supervisors trained	Stock records up-to-date Accurate stock recoding
Secure storage	Train storekeepers	Facility locked and guarded
Track appropriate insecticide usage	Monitor issued/used sachets	Sachets collected and counted
Ensure adequate supervision of spray operators	Train site managers, supervisors and team leaders	No occurrences of acute poisoning as a result of program
Enable responses to emergency	Train supervisors to recognize symptoms	Soap and water available at storage facility
	Train storekeepers	Store keepers trained
	Train health workers	Health worker trained
		Poisoning treatment medicines available at health facility
	Train drivers	Lack of vehicle accidents
		Lack of major spills during insecticide transport
Ensure protective gear worn during operation	Train supervisors and spray operators	PPE in good condition/all necessary PPE worn
Personal hygiene		No eating, drinking or smoking witnessed during operations
Pregnancy test or other means	Train health workers	Women not present on teams OR pregnancy testing and asked about

		breast feeding
Regular urine or blood sampling	Train appropriate entity	Exposure levels determined, appropriate action taken
Educate residents on IRS	IEC/BCC campaign	Persons outside house
		Food and goods outside house
		Furniture covered
		Resident stay outside house for two and half hours after spraying
		Residents sweep floor
Ensure appropriate dosage of insecticide applied to wall	Supervisor and spray operator training	45 cm distance from wall
		1m/2.5 sec spray rate
		75cm swath width and 5cm overlap
		790ml/min discharge

In all operational sites, there was a special cleaning area for the cleaning of spray pumps (progressive rinsing) and washing of PPE. The washing areas and soak pits were constructed according to WHO standards and the PERSUAP. On a daily basis, the water from progressive rinsing was collected and stored in tight sealed drums for recycling in the first charge of the next day. Water from PPE washing flowed directly into the nearby soak pit. These areas were well protected by a fence which surrounded the entire area including the soak pits, in addition to the guards who were posted 24 hours a day.

Environmental Compliance Supervision

To ensure that environmental standards were adhered to, the IRS project worked hand in hand with the district environmental officer from the Department of Environmental Affairs throughout the operation. Environmental compliance inspections were made to evaluate mitigation measures prior to the commencement of the actual spray. During the campaign, additional inspections were conducted by Gaspard Bikwemu, Senior Environmental Specialist and a USAID inspector. These compliance inspections had the following objectives:

- Observe IRS activities in progress and determine and document whether the intervention is in full compliance with USAID requirements as included in the approved supplemental environmental assessment (SEA);
- Create baseline of current compliance activities for the purpose of evaluating improvement in future IRS programs;
- Determine current actions that can taken immediately to comply with the country SEA;
- Determine, in consultation with district officials, the training and support required to improve and ensured future compliance with SEA;
- Ensure adherence to the relevant rules and regulations including 22 CFR 216.

Both inspecting teams were satisfied with the environmental compliance practices and measures put in place. There were no serious issues (spillage/pilferage) or adverse events reported associated with the spray exercise

Closing of IRS Operations

Spraying ended on November 29, 2008 and the closing ceremony was held the following day at Ngala beach resort. All stakeholders and IRS partners were invited to the ceremony.

Post-spray IEC Surveys

Three post-IRS visits were made to different representative areas to evaluate the spray exercise. A total of 45 village chiefs were visited and interviewed in order to collect information on adverse events and incidents related to poor spraying practices, but the survey revealed no such occurrences. However, the chiefs expressed some worries on the part of their villages regarding misconceptions that the pesticide would interfere with their fertility or antagonize some traditional power.

Community Meetings

Post-spray community meetings were conducted to share the results of the spray exercise with the community, to get feedback on the performance, and to explore community concerns regarding the IRS program. A total of sixteen open forum meetings were held within the intervention area. Each health sectorial area conducted at least one meeting; however in some larger sectors (Dwambazi, Ngala, Nkhunga, Liwaladzi and Msenjere), two meetings were conducted. A total of 1,141 participants attended the meetings, among them 376 women.

A group discusses community impressions of IRS.

- The information collected from the community meetings will serve as crucial inputs into the development of IEC materials and will help to assess the best methodologies for advocacy for future campaigns. Although the meetings revealed that the majority of the population believes that IRS is effective, a small number held misconceptions regarding the intervention.

The meetings also revealed that many of the refusals by householders to have their homes sprayed were the result of anger in response to:

- Failure to be given free bed nets;
- Biased distribution of coupons for subsidized fertilizer which given to the community under a special government program;

- A land dispute in Nkhunga and Ngala sectors in which the Cane Growers Limited took land from families for the scaling up the cane growing project.

Some participants disclosed that because the spray operations coincided with the primary election campaigns, they were unable to be at home during the spray round. Most of these households were revisited and sprayed during mop-up operations.

Post-spray Partnership Meeting with Illovo Spray Management

A meeting with the Illovo medical officer Dr. Henry Chakaniza and the agronomist Mr. Evans Masamba was held on December 9, 2008 to discuss the outcome of spraying in the Estate. During this discussion, the company expressed concern that the IRS project overreacted to the incident of missing insecticide in deciding not to supply further insecticide to Illovo and rather to spray the Estate itself. The parties also explored the reasons behind low insecticide usage and the low number of households found during this round in comparison to the first round. Illovo indicated that during the first round, offices, classrooms, and factories were sprayed in addition to structures in which people sleep, accounting for the difference in eligible structures found in the field.

Demobilization and Waste Disposal

Following completion of spray operations, the IRS project handled the transportation and storage of remaining insecticide, pumps, and other commodities to a new storage facility in Lilongwe. Progressive rinsing barrels and washing buckets were also collected and stored during the demobilization exercise.

Solid waste from the campaign, including packaging materials, torn gloves and used masks, was collected and assembled with the stored solid waste from the first IRS campaign. The waste was properly disposed of as per the procedures outlined in the SEA, by incineration at the Nkhotakota district hospital.

Empty insecticide sachets are packed into the incinerator for disposal.

IRS Results

Each spray operators is expected to spray a minimum of six households per day. After the completion of each house, a household spray sticker was placed on the front door of the household in order to differentiate between the sprayed and unsprayed house. The necessary information about the household, including the number of eligible structures sprayed and unsprayed, rooms sprayed and unsprayed, population, and availability and use of bed nets, was recorded by the operator in the provided form and submitted to the team leader. At the end of the operation day, the team leader compiled all the daily reports from his respective operators and submitted them to the supervisor, who did the same. Then the summary forms were verified, compiled, and sent to the data management unit for data entry.

During this round of spraying, 21,409 households were sprayed out of 22,054 found in the field, for a coverage rate of 97.1 percent. The total number of structures found was 26,562, of which 24,764 (93.2 percent) were sprayed. An average of three rooms per household were sprayed for a total of 74,426 rooms. A total of 14,200 sachets of ICON ®10 CS were utilized with an average of 0.57 sachets per structure.

The summary indicators for second round are illustrated below.

Figure 7. Summary results.

	Projected	**Sprayed**	**Coverage**
Households	22,054	21,49	97.1%
Structures	26,562	24,764	93.2%

The total population protected by IRS was 106,450 people, of which 24,198 were children under five years old and 2,753 were pregnant women. A total of 27,205 bed nets were found, and 14,896 (61.6 percent) of under-fives slept under an insecticide treated net on the previous night. One thousand five hundred thirty two (1,532), or 55.6 percent, of pregnant women slept under an insecticide treated net on the previous night.

Lesson Learned and Recommendations

Unreliable Existing Data

- Most of the villages have fewer actual households than the estimated figure reported before the spray campaign. This discrepancy led to many miscalculations and weakened the distribution of spray operators.

Recommendation

- The existing data on households within the spray area are unreliable. There is a need for proper geographical reconnaissance within the spray area and every new intervention area before each spray operation.

Community Acceptance of IRS

- Low community awareness regarding the importance and effectiveness of IRS.

- Existence of speculations and misconceptions regarding the IRS and insecticide use within the community.
- Complaints from the community that the mosquitoes are still big nuisance despite IRS (due to inadequate knowledge on the effects of ICON on other species of mosquitoes).
- Inadequate distribution of free ITNs and fertilizer coupons to eligible population. Some householders who did not benefit from these interventions refused to comply with the IRS program.
- Land disputes: Families who had their land taken by the Dwangwa Cane Growers Limited through the MOG refused the spraying of their houses.
- Coincidence of the program with the primary elections campaigns.

Recommendations

- Adequate and appropriate IEC materials including banners brochures, billboards, leaflets, and posters must be developed and distributed to the community.
- IRS should be integrated to other health promotion campaigns such as school health programs targeting school teachers and learners, malaria intervention packages like case management and bed nets, and maternal and child health focused programs.
- Community mobilization on IRS should be treated as a continuous activity.
- Other community health interventions should offer adequate community education. For instance, during the distribution of bed nets to children under five and pregnant women, the community should have been made to understand of their eligibility for the nets and the impact of scarcity of resources.
- Lesson learned: The utilization of community mobilizers and chiefs and village volunteers has had a documented significant positive impact on uptake and acceptance of IRS within the community. This should be continued in future rounds.

Operational Difficulties

- Spray operators struck for a salary increase at the beginning of the actual spraying.
- Time restraints during preparation caused some issues regarding the timely and proper completion of TOT and geographical reconnaissance.
- Failure to have reliable database: the database developed with support from CDC was found to have critical errors which compromised data analysis.
- Difficult supervision in the field as a result of transportation issues.

Recommendations

- Salary should be transparently addressed during the recruitment of the spray team to avoid recurrence of the problem.
- Adequate time is required for organizing proper IRS implementation, including planning, monitoring and implementation.
- The IRS project should recruit data management staff and develop its own database based on PMI indicators.
- For effective supervision, the project should buy motorbikes for supervision, as those borrowed from the District Health Office were old and unreliable.
- To effectively cover the entire district of Nkhotakota, the camping strategy is an option to consider because of long distances to the field. In order for spray teams to camp in the

Appendix A
IRS Sustainability Chart

Activity	Proportional Responsibility (%)							
	Round One		Round Two		Round Three		Round Four	
	MOH	RTI	MOH	RTI	MOH	RTI	MOH	RTI
Partnership development								
Establish IRS oversight committees	50	50	80	20	90	10	90	10
Environmental compliance								
Prepare Environment Assessment	20	80	20	80	50	50	80	20
Environmental monitoring Plan	0	100	20	80	40	60	50	50
Environmental compliance inspection	0	100	10	90	20	80	20	80
Entomological surveillance								
Identify and train entomological technicians	50	50	60	40	80	20	90	10
Baseline survey	10	90	50	50	80	20	90	10
Periodic surveys	10	90	60	40	80	20	90	10
IEC Program								
Formative research	10	90	90	10	90	10	90	10
Training of IEC mobilizers	0	100	50	50	70	30	90	10
Production of materials	0	100	10	90	90	80	40	60
Pre-IRS IEC mobilization	10	90	50	50	70	30	90	10
IEC coordination with IRS	0	100	50	50	70	30	90	10
Post spray IEC survey	10	90	40	60	50	50	50	50
Logistics procurement and management								
Field visit for logistics needs assessment	50	50	50	50	60	40	60	40
Issue requisitions	0	100	10	90	50	50	50	50
Logistics delivery	0	100	10	90	50	50	50	50
Micro-planning	50	50	50	50	50	50	50	50
Logistics chain of custody	0	100	10	90	30	70	30	70
IRS operations								
Geographical reconnaissance	10	90	20	80	40	60	40	60
Training of supers and SOPs	0	100	20	80	20	80	20	80
Spraying operations	10	90	20	80	20	80	20	80
Post spraying Activities	50	50	50	50	80	20	80	20