



PRESIDENT'S MALARIA INITIATIVE



## INDOOR RESIDUAL SPRAYING FOR MALARIA CONTROL

# Malawi Spray Performance Report for Round Ending March 2008

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

June 2008

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

Prepared for:  
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## List of Acronyms

CDC	Centers for Disease Control and Prevention
CHSU	Community Health Services Unit
CS	Capsule Suspension
DHMT	District Health Management Team
DHO	District Health Office
EA	Environmental assessment
EIA	Environmental Impact Assessment
EPA	Environmental Protection Agency
GCDPP	Global Collaboration for Development of Pesticides for Public Health
HSA	Health Surveillance Assistant
IEC	Information, Education and Communication
IQC	Indefinite Quantity Contract
IRS	Indoor Residual Spraying
IVM	Integrated Vector Management
ITNs	Insecticide Treated Nets
LLIN	Long Lasting Insecticide Treated Net
MOH	Ministry of Health
NMCP	National Malaria Control Program
PEA	Programmatic Environmental Assessment
PERSUAP	Pesticide Evaluation Report and Safer Use Action Plan
PMI	United States President's Malaria Initiative
PPE	Personal Protective Equipment
RTI	RTI International
SEA	Supplemental Environmental Assessment
TOT	Training of trainers
USAID	United States Agency for International Development
WHO	World Health Organization
WHOPES	World Health Organization Pesticide Evaluation Scheme
WP	Wettable powder

## Background

Malawi was identified as one of the second wave of countries to receive funding under the United States' (U.S.) President's Malaria Initiative (PMI). PMI Malawi and the Malawi National Malaria Control Program (NMCP) identified Nkhotakota District for initial Indoor Residual Spraying (IRS) activities. In 2007, PMI and the NMCP proposed one round of IRS in this rural area in partnership with the Dwangwa Sugar Estates to demonstrate applicability and feasibility, document costs, and determine personnel, management, administrative, and supervisory needs. The experience in Nkhotakota will inform future decisions on the role of IRS in Malawi.

RTI is tasked with providing strategic, technical, management and operations support for IRS activities in Nkhotakota District. RTI, NMCP and the District Health Management Team (DHMT) targeted 26,500 households with residual insecticide in Nkhotakota District during the first round of IRS.

This spraying performance report summarizes the program's activities in support of the spray round which began November 27 and ended December 28, 2007, with a mop up round from March 18—30, 2008.

## Summary Results

- Number of households sprayed
  - Initial round: 23,450 households (90.2% of target) in Nkhotakota District
  - Dwangwa Sugar Estates 3,450 households (98.2% of target)
  - Mop-up round: 1,327 households (89.8% of target)
- Population protected
  - 130,000 total
  - 25,677 children under five

## IRS Operations

The IRS program was proposed in rural areas north and south of the Dwangwa Sugar Estate in Nkhotakota District to demonstrate applicability and feasibility, to document costs, and to resolve personnel, management, administrative, and supervisory issues. This activity was done in partnership with the Dwangwa Sugar Estate and was estimated prior to operations to include approximately 26,500 households, of which approximately 3,500 were in the Sugar Estates themselves. The Nkhotakota District area was chosen based on the intensity of malaria transmission and burden of disease, as well as the potential applicability to other rural areas in Malawi. The district was previously used for vector assessments, has distinct boundaries on Lake Malawi on the east and national forest on the west, and has included IRS as a proposed activity in its District Implementation Plan. In addition, the sugar estate, which already has an IRS and ITN

program for employees, would provide an opportunity to establish a formal public-private partnership.

The 1<sup>st</sup> phase of IRS started on November 27, 2007 and ended on December 28, 2007. A total of 23,450 households out of the original target of 22,500 households were sprayed excluding Illovo Sugar Estates. A mop-up round of spraying was done March 18-30, 2008 in villages where some households were left unsprayed due to shortage of insecticide, incomplete geographical reconnaissance and areas where there were pockets of resistance at the beginning. The mop-up round was delayed by the late delivery of pesticide. These households are located from Kaombe Bridge up to Nkhotakota – Nkhata Bay border which covers the areas of Bua, Msenjere, Katimbira, Liwaladzi, Nkhunga, Ngala, Kasitu, and Dwambazi. The data collected from this activity will inform future decision-making on IRS.

### **Choice of District**

Epidemiologically, Malawi is considered to have stable intense perennial malaria transmission with high peak season between December and March. Different malaria control interventions or combinations of interventions are necessary to reduce malaria transmission.

Nkhotakota district is a well defined geographic area with Lake Malawi on the east side and the Nkhotakota Game Reserve on the west side, making it an "island-like" area for IRS purposes. It has high intensity of malaria transmission throughout the year. Entomological data gathering has been ongoing; hence it has baseline information vector distribution and other malaria parameters. Before operations began, the local anophelines were tested for susceptibility to WHO approved pesticides and found to be susceptible to all.

While it is accepted that effective IRS produces a reduction in malaria transmission, it should be understood that in combating malaria one single intervention is not adequate to address the problem. Indoor Residual Spraying is a complement to, not a substitute for, a well planned malaria prevention and control program. Nkhotakota has ITN/LLINs in use, and readily available treatment.

The Dwangwa Sugar Estate has been practicing IRS for several years prior to this spray round, using lambda-cyhalothrin and alpha-cypermethrin. This resulted in a reduction in malaria transmission, but due to cutting off the geographical spray area in the middle of populated land mass, the potential for substantial reduction in transmission was reduced. It is thought that by extending the spray area boundaries to low density population open spaces, the impact of spraying within the Sugar Estate can be greatly enhanced.

### **Objective of IRS**

Protect 85% or more of houses in geographic areas targeted by IRS.

### **Consultative Meetings**

Several meetings were held at different stages of preparation to discuss IRS activities in Nkhonkhotakota. In these meetings it was agreed that RTI, in collaboration with District Health Office and National Malaria Control Program, would collaborate on the IRS program in Nkhonkhotakota. Several other meetings were held with RTI, Environmental Affairs, NMCP, USAID and other partners to inform and seek advice on the IRS operations.

### **Environmental Assessment**

RTI conducted a Supplemental Environmental Assessment (SEA) in June 2007 to support USAID's environmental review as required under 22 CFR 216. In addition, and per Malawi environmental regulations, RTI adapted the SEA to fulfill the requirement for a local Environmental Impact Assessment. The SEA focused on an assessment of pesticide use (chemical, toxicological and ecotoxicological features). In addition, the status of vector resistance to pesticides was reviewed to determine how IRS operations would interact with vector control activities. This review included an analysis of relevant regulations regarding pesticide use in Malawi. As required by the Government of Malawi, the IRS Program was required to seek:

- a. Approval by Malawi Pesticide Control Board for use of lambda-cyhalothrin
- b. Approval by the National Council for the Environment for IRS in Nkhonkhotakota

### **Selection of Insecticide**

Lambda-cyhalothrin (ICON™ 10% CS) was selected as the insecticide for IRS Project in consultation with the National Malaria Control Program and CDC as a balance between the known health and economic risks of malaria and the environmental risks of IRS. Lambda-cyhalothrin is a commonly used synthetic pyrethroid for pest control—especially mosquitoes—and it is usually sprayed on interior walls or used to impregnate bed nets. Lambda-cyhalothrin was selected as the choice of insecticide for the following reasons:

- Lambda-cyhalothrin is approved by WHO for use in IRS and, according to the PEA for IVM, poses a low health risk to both spray operators and resident beneficiaries of the IRS program.
- It is registered in Malawi for public health use.
- The ICON 10CS formulation of lambda-cyhalothrin has been shown to have longer residual effects than other pyrethroid insecticides and could increase the amount of time between spray rounds, a large potential savings for Malawi.
- Technical and logistical factors such as appropriateness of surface for spraying, the costs of the insecticide, and resistance management.

### **IRS Logistic Needs Assessment**

National Malaria Control Program staff and DHMT staff supported by the RTI IRS Operations Director, Kim Canelas, conducted a logistics assessment for IRS operations in Nkhonkhotakota. The assessment examined the range of costs required for IRS such as financial, human resources, insecticide, storage and staging facilities, and other aspects.

The information was derived from field surveys, interviews with different stakeholders, and site visits.

### **Timing of IRS**

In most locations IRS is best conducted just prior to rainy seasons in order to protect the population before the malaria peak transmission. This timing also helps with ease of operations since roads are more passable and householders have an easier time removing their possessions from their houses when it is not raining. For many reasons, particularly the availability of insecticide and PPE, IRS in Nkhotakota was delayed and spraying took place on some very wet days. While inconvenient, this delay did not prevent spraying and most houses were sprayed before the expected annual increase in malaria transmission.

### **Establishment of IRS Technical Committee**

A multi-sector Technical Committee was formed under the leadership of District Health Officer in Nkhotakota. The committee comprised stakeholders from different key line ministries including research institutions and local authorities. These included government district heads: District Health Officer; District Commissioner; Program Manager, Agriculture Department; Social Welfare Officer; and District Water Officer. The committee was also attended by NGO representatives from World Vision International, Concern Worldwide, Malawi Red Cross, MACOHA, Nkhotakota Aids Support Organization, SWAM, and World Medical Fund. Chiefs and other political representatives also took part.

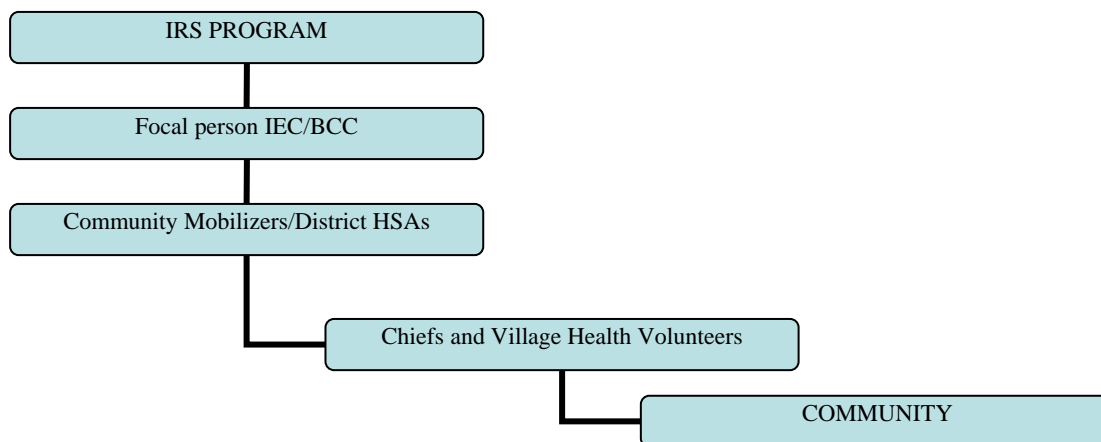
### **Information Education Communication (IEC) and Community Mobilization for IRS**

Community education with malaria advocacy campaigns started on November 12, prior to implementation of IRS activities. One hundred nineteen Health Surveillance Assistants (HSAs), operating from the grassroots village level, gathered for a three-day mobilizer training. Village volunteers and village chiefs received a one-day package of IEC training to enable them to participate actively in the campaign. Alex Coburn, a Peace Corps Volunteer posted in Nkhotakota, provided exemplary assistance to the IEC activity as well as other aspects of IRS community mobilization. He also adapted some of the IEC materials to local language and conditions.

The aim of community mobilization was to raise the level of awareness and understanding in the community on the importance of IRS and involve them in taking action to ensure IRS coverage. Advocacy approaches included community meetings, community criers, door-to-door visits, and local radio public service announcements. During the first week of operations community mobilization got off to a rough start, with some mobilizers telling households that presence of a pregnant woman or of a child less than six months of age would disqualify a household from being sprayed. This required intervention on multiple levels to correct. Mobilizers had to be reoriented. Staff revisited areas where inaccurate messages were used and spoke with householders. DHMT staff and Dwangwa Medical Director played an active role in this.

At one point during the spray operation, HSAs had a scheduling conflict with Child Health Week. Fifty standby spray operators were called into service as mobilizers to maintain continuity of communications during this period. The standby operators were assigned to areas close to their homes and continued working on communications and mobilization after the HSAs returned to IRS activities. Two lessons emerge from this. One is that the use of HSAs as mobilizers for IRS will always pose a risk of interfering with their other duties, and can disrupt either or both. The second lesson is that the spray operators performed quite well as mobilizers. Supervisory staff noted that they were accurate in their messages and communicated well with household members.

Following initial community input, we learned that among the existing gaps which might significantly affect the program, especially in the area where there were some pockets of resistance, was less than ideal community involvement at the village and sub-village (cluster) level. In this aspect, the program decided to involve more actively the existing Village Health Volunteers to maximize uptake and acceptance.



Several community meetings were conducted in each village to disseminate IRS information, raise community awareness of the importance of integrated malaria control activities including IRS, and to involve communities in taking positive action to ensure high acceptance and coverage. Village meetings comprised chiefs, school teachers, religious leaders, political leaders, and villagers.

IRS messages were aired through Nkhotakota Community Radio explaining the importance of IRS and the preparation to be done prior to spraying. These radio announcements were also broadcast during the actual spraying campaign and were valuable for announcing the schedule of operations prior to the spraying days. There were 38 announcements during the spray round and ten more during the mop-up round.

### **Training of Village Volunteers and Mobilizers during Mop-up Round**

To maximize the community uptake and acceptance and ensure good preparation of houses before spraying activities in the mop up round, changes were made in conducting community mobilization. For the mop-up, the best of the community mobilizers from the original round and village health volunteers were selected and given an additional one-



day training. This training was aimed at developing effective communication techniques and message accuracy. A total of 119 mobilizers and village volunteers attended the training, where misconceptions and community concerns were discussed in great detail. Essential information regarding IRS was reviewed, including preparation of the households, timing, and what to do and not to do following spraying. This activity was conducted in local language (Chichewa). IEC workers spent more time on door-to-door communication in the mop-up.

### **Logistics for Spray Teams**

The project used two warehouses, located at Dwambazi and Dwangwa, where all spraying equipment and supplies including insecticide were stored for safety and security. All of the required equipment was in place before the actual operation. This equipment included insecticides, sprayers with accessories, spare parts, and personal protective equipment for spray operators. Each warehouse had its own storekeepers with full security measures. In both storage sites, facilities such as water for spray teams and cleaning teams, toilets for washing and changing, and soak pits for contaminated water disposal were provided.

### **Insecticide Management**

All spraying equipment and supplies including insecticides are recorded in the ledger book and stored for safety and security in the warehouse located in the main Dwangwa warehouse. This building, owned by the Dwangwa Cane Growers, was rehabilitated to comply with standard IRS protocol. All of the required equipment and supplies were issued to operators in compliance with SEA storage procedures. The six store management staff were supervised by RTI and DHMT staff.

At the beginning of spray operations there was a breakdown in correct pesticide management procedures. Stock control procedures were not enforced resulting in the loss of 960 sachets (issued but not returned empty). Over 300 of these were later recovered, having been used and discarded empty in the field. Standard procedure requires that operators who cannot account for sachets are to be removed. When the situation became known, corrective work was done in the warehouse at Dwangwa to bring pesticide management into compliance with the SEA and best practices, and stock control was rigidly enforced. Following intervention, the storekeeping team complied with safety measures to prevent spillage, prevent pilferage, and maintained good practice of pesticides stock control through the rest of the operation. No more sachets were lost after that in the main round. During the mop-up round one sachet went missing. The Team Leader in charge of that team was dismissed.

At the end of the spray operation three Hudson Xpert spray cans were missing. After questioning of staff it was not conclusively determined when they went missing or how. Two hundred spray cans were borrowed from Zanzibar IRS program and it appears that two of the missing cans may have been shipped to Zanzibar at the end of operations. One can went missing during the island spraying and may have been stolen. Storekeeper protocols were more rigidly enforced as operations went on.

### **Insecticide and Spray Equipment Requirements**

Hudson X-Pert® sprayers, WHO approved for IRS operations, were recommended and used during IRS operations. One hundred thirty sprayers were bought with spare parts. When spray operations were delayed an additional 200 sprayers were borrowed from the IRS program in Zanzibar in order to increase the number of spray operators available to be in the field at one time. Sets of spare parts were left under the care of team leaders during the working time in case of any problem. Personal Protection Equipment (PPE) in line with WHO specifications were provided to each spray operator and the team leaders.

Syngenta Limited provided ICON 10% CS insecticide that was ordered and arrived in Malawi in November 2007. The original shipment was 19,200 sachets of ICON, of which 2,000 went to the Dwangwa Sugar Estates. Another 2,500 sachets were procured for mop-up, with 1,430 remaining in secure storage at the Dwangwa Sugar Estates herbicide/pesticide storage facility.

### **Transportation**

Vehicles were hired from the local business community. A total of 18 minibuses were engaged. These vehicles were used to transport spraying teams and equipment from warehouses to operational areas. One four-wheel drive vehicle was used for transport to supervise and provide support to the teams as necessary and to carry spare tanks, protective gear, and pesticide as back-up. It was also used to move operators to another village when extra forces were needed. During the mop-up exercise, two motorbikes were used to enable the supervisors to cover the working area with ease. The minibus drivers were also used in the community to disseminate information on IRS.

Fuel is a significant cost for IRS operations, and disputes over fuel are common. This was the case in Nkhotakota. During the mop-up, the method by which fuel was reimbursed was changed to a per kilometer basis, which helped to control costs and reduce disputes.

### **Preparation of District Profiles and Geographical Reconnaissance**

The IRS administrative team put together information required before the commencement of IRS with the support from RTI and CDC. Available information, especially from the National Census Records and Health Sectors from Health Surveillance registers which showed the number of households and inhabitants was used to generate IRS plan. Much information proved to be at variance with the number of households and total population found in the field during operations.

### **Selection of Spray Teams**

The role of selecting/recruiting short-term contracted spray operators was mainly the responsibility of the District Health Management Team. The selection procedures provided an equal opportunity to all villages in the target area. At the end of the process, almost all villages had representatives selected. RTI assisted the District Health Office (DHO) by providing the criteria for selection of spraying operators.

### **Pregnancy Testing**

To prevent possible teratogenicity from lambda-cyhalothrin, all women were tested for pregnancy and removed from contact with pesticide if found to be pregnant. This was done at the last minute, on the first day of operations but still prior to spraying. This late testing was disruptive. Future rounds should test 7-10 days prior to operations to allow for adjustment of teams. Of the 84 women spray operators who completed training, two tested positive in the initial spray operations. Two more tested positive at the beginning of the mop-up exercise.

### **IRS Team Structure**

A total of 242 spray operators were used in the spray operation. Within the impact area there were eight health centers, excluding the Illovo estate: Bua, Msenjere, Katimbira, Liwaladzi, Nkhunga, Ngala, Kasitu, and Dwambazi. Each health center area was assigned one supervisor who supervised between three and six teams, depending on the total number of estimated target households within the catchment area. Each team had a team leader supervising six spray operators. In addition, there were eleven extension workers from the Agriculture, Water and Health Departments who were monitoring the IRS program.

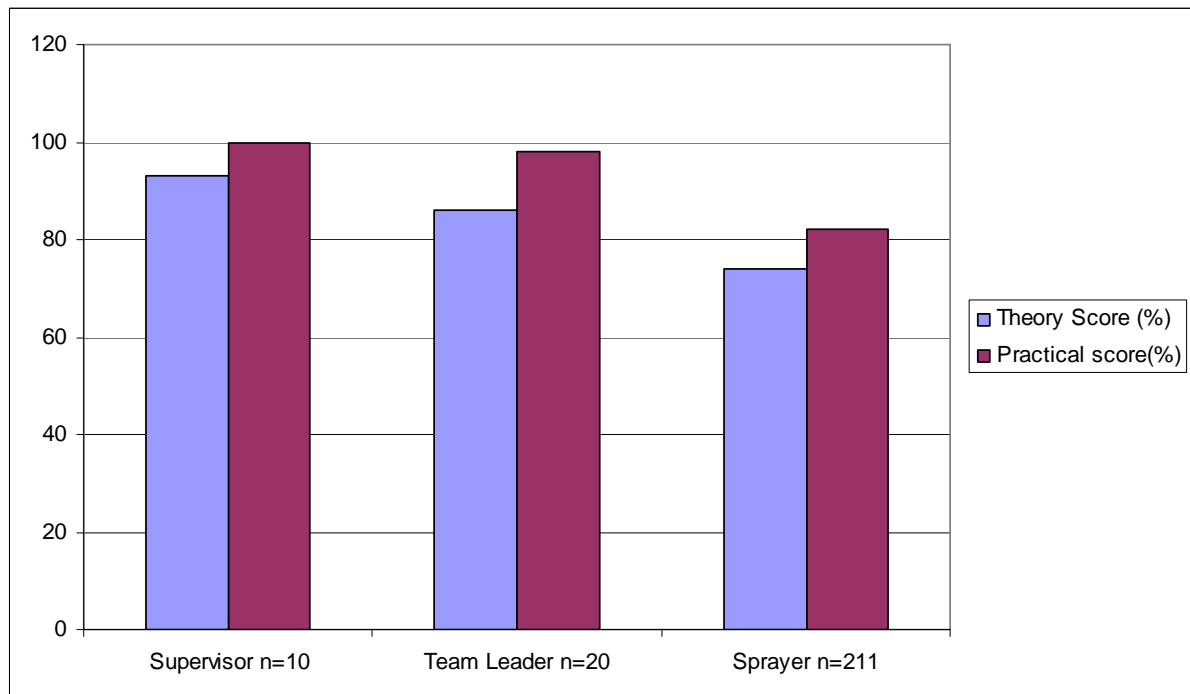
### **Training of Spray Teams**

Based on the educational background of the participants, intensive formal training was conducted in two different groups. Because of the tight schedule, one group received four days and the other received five days of intensive training (maximum eight hours a day). Training time should be expanded in future to allow for more "on the wall" practice and to ensure retention of critical skills and knowledge. Prior to actual training, training needs were identified in order to shape the training contents accordingly. Training covered both theory and practical component, as per the WHO spraying technique guideline.

The Hudson Sprayers came with incorrect nozzles and some trainees went through training with these. Distance and speed of application would not be changed regardless of nozzle size, but the "feel" that the operator gets while spraying would not be the same. Trainees should, whenever possible, use nozzle(s) appropriate to the chemical(s) for which they are being trained.

Participants' knowledge and skills were regularly assessed through physical demonstration, especially on handling and operating the Hudson pumps and filling out operational spraying forms. A total of 345 spray operators, including team leaders and supervisors, were trained, of which 242 were retained. The remaining 103 operators were reserved for gap filling during the actual operation. The spray operators were provided with an operating manual to enhance their understanding of the IRS operation.

Supervisors and team leaders were selected on the basis of performance during training. When tested, the mean scores for supervisors were 93.3% on theory and 100% on practical skills (see graph below). Team leaders' average scores were 85.8% on theory and 97.5% practical skills. Spray Operators had an average theory score of 73.6% and an average of 82.4% practical.



Mean scores of Supervisors, Team Leaders and Sprayer Operators following training.

### **Training and Teaching Materials Used**

*A manual for IRS: Application for Residual Sprays for Vector Control* (WHO/CDS/WHOPES/GCDPP/200.3 Rev.1) provided the curriculum for spray operators training. This curriculum was supplemented by training materials developed by RTI in other PMI countries in Africa.

Hudson Sprayer pumps were used during training. Most of the spray operators had never used spray pumps. Therefore, explaining every part of the spray pump and performing simple procedures was very important. For practical reasons during the training, a special cement plastered wall was prepared for the participants to practice. The operators spent hours perfecting their spray techniques on the plaster wall.

### **Training Contents**

- Rationale for IRS
- The spraying equipment, disassembly and reassembly
- How to carry and manage the sprayer
- Sprayer pressurization and depressurization
- Spraying
- Care and cleaning of sprayer
- Spraying in difficult situations
- Insecticide handling and safety mitigation measures
- Site preparation and communication skills
- How to collect information and fill in record forms

- Supervision of all IRS activities as well as administrative management and planning

### **Training of the Teams on First Aid Measures**

The teams including mobilizers and monitors were trained on how to recognize the signs and symptoms of acute poisoning and how to provide first aid measures. Proper measures were described in case of ICON contact with the skin, eyes etc.

### **Training of Drivers**

The safety of environment and spray teams are in the hands of drivers during transportation of the teams. Adherence to safety precautions to prevent accidents and spillage and an understanding of safety measures and actions to take in the event of such incidents is the most crucial. The training given to drivers for the initial spray round covered the basic elements of pesticide safety and adverse event response. Supervision and follow-up showed that this training did not produce the desired result. A follow-up training was conducted to address this. Drivers training was expanded for the mop up round.

## **Spray Operations**

### **Development of Spraying Schedule and Dissemination of Information to the Community**

The data collected on number of households and village allocation through chiefs and DHS showed information on the number of households per village and number of inhabitants per household. This information was used to generate the spraying schedules. The schedules were submitted to local radio (Nkhotakota Community Radio) for broadcasting throughout the spraying days. This information was aired at least two days prior to actual spraying day. In addition to radio broadcasting, the volunteers and mobilizers walked through villages using megaphones to announce the schedule and steps to prepare houses for spraying.

### **Field Supervision**

IRS spray operations require continuous intensive field supervision and team coordination. A special working tool was developed as a check list to ensure the proper and effective supervision. This supervisory tool (Annex 1) used by team leaders and supervisors during operations to ensure that spray operators comply with good spraying practice and any gaps or errors are immediately noted and corrected at the site. Daily feedback from the field to the supervisory staff is vital. This practice helps to rectify observed gaps and share experiences as early as possible.

### **Organization Structure**

Each day of operations, supervisors, team leaders and sprayer operators prepare sprayers, insecticide, recording forms, and household spray cards. At the operation site the teams put on protective gear to prepare for spraying. Immediately after the arrival at the

operational targeted area (village), the teams are instructed to meet with community leaders (chiefs) and volunteers for spraying arrangements. The spraying operators were usually distributed at different locations of the village and accompanied by selected community members. At this point, the role of supervisors and team leaders becomes prominent.

Each sprayer operator was expected to spray a minimum of six households per day. Field observation revealed different performances in terms of number of houses sprayed per day depending on logistical aspects. When the operator reached an individual household, in most cases, the occupant had already been prepared for the spraying. Operators filled out a household card and spoke with residents before proceeding inside. When the house was shown to be empty and ready for spraying, operators would spray all appropriate surfaces.

Afterwards, instructions on safety precautions after spraying were given to the household members (remaining outside, opening the doors and windows, and staying again outside for 30 minutes, cleaning the floors (if necessary), bury or place in pit latrine all dead insects). The house occupants were advised to wash immediately with soap the affected site in case of skin contact with the insecticide and to report to the spraying team or nearby health facility in case of an adverse reaction. The family was also instructed not to re-plaster or paint the walls after spraying so as to retain the residual effects of the pesticide

### **Information Management**

Necessary information including as number of rooms sprayed or unsprayed, number of people living in the household including under-five and pregnant women, number of treated or untreated nets, etc. was recorded. At the end of the day, team leaders compiled and checked all the daily reports from their teams for completeness and accuracy and submitted them to a supervisor. Finally, the forms were verified, compiled and sent to the data management unit for data entry.

### **Cleaning and Maintenance of Equipment**

When the spray teams returned from the field, the spray operators clean all spraying equipment according to the progressive rinse cleaning protocol. They remove personal protective clothes/gear and clean and store them under the supervision of the team leaders and supervisors (supported by logisticians). Water used for progressive rinsing is collected and used the next day. Water used at the last day of IRS was disposed of by biodegradation process.

### **Supportive Activities**

The program developed a system to support the smooth functioning of the program. The logisticians handled equipment and transport problems during the exercise. Protective overalls, boots and gloves were sent for washing after every three days. In the main store, the storekeeper and his team were accessible at all times, issuing equipment and supplies to the spray teams. While spray teams were in the field, communication among the

teams, central operating sites and village volunteers and chiefs was strengthened by the use of mobile phones, which played a very valuable role throughout IRS operation.

During the initial planning NMCP, Nkhotakota DHMT, CDC and USAID collaborated on planning process. Syngenta, based in Kenya (ICON manufacturer), supported the operation by providing an expert trainer. Staff from Dwangwa Sugar Estate, both agronomists and medical personnel, with excellent experience using ICON for IRS, participated in the training, planning and oversight of operations. Farmer's Organization of Blantyre also provided a trainer. The presence of local, Malawian trainers proved valuable and should be emphasized in future trainings.

### **Safety**

Precautions were taken to ensure that safety standards were adhered to throughout the IRS activities within the spray team and community. These were emphasized during the pre-spraying training of the spray teams and community mobilizers. Operational measures to control spillage and pilferage and to prevent poisoning were laid out. Within the community, adequate information on household preparation was conveyed. Special fact sheets were developed to guide the community and clinicians in case of an adverse insecticide reaction. Washing soaps, petroleum jelly, and skin lotions were given to the spray teams throughout the IRS activity to treat skin irritation and availability of an ample water supply was also ensured. A few mild effects (mainly contact dermatitis) were reported by operators and easily managed (see Annex 3, Exit Medical Report).

### **Results**

Spraying took place in two phases, a main round of operations and a mop-up. In the initial phase, November 28—December 28, 2007, 23,450 households were sprayed and during the mop-up phase, March 18—March 30, 2008, 1,327 households sprayed. The Dwangwa Sugar Estates sprayed an additional 3,450 households using their own staff. The grand total of households sprayed was 28,452.

A total of 18,269 sachets of ICON 10CS were used with an average of 0.64 sachet per household. During the initial phase of operations, 17,200 sachets were used and during the mop-up 1,069 sachets used. Two thousands sachets of ICON were given to Illovo Sugar Estate for spraying of their own households.

### The Spraying Results:

Sector	Total # of Households Sprayed	Rooms sprayed	Total Population Protected	Under-five protected	Ownership of treated nets	Untreated Nets
<b>Bua</b>	3,830	11,080	19,265	4,129	2,429	2,783
<b>Msenjere</b>	4,254	11,599	19,451	3,763	2,735	2,615
<b>Katimbira</b>	2,433	6,811	13,150	2,505	1,716	2,103
<b>Liwaladzi</b>	2,708	8,600	14,166	2,873	2,062	1,813
<b>Nkhunga</b>	4,274	12,366	20,345	3,891	2,708	2,785
<b>Ngala</b>	3,793	10,489	12,969	2,989	1,740	1,929
<b>Kasitu</b>	3,679	5,934	8,039	2,075	744	925
<b>Dwambazi</b>	3,481	9,567	13,869	3,452	1,732	1,664
<b>Total</b>	<b>28,452</b>	<b>76,446</b>	<b>121,254</b>	<b>25,677</b>	<b>15,866</b>	<b>16,617</b>

Reasons for households not being sprayed include:

- Presence of seriously ill patient in the house
- Household being closed/owners are away for fishing/cultivating camping, or funerals
- Presence of recently delivered mother and unacceptable (culturally) to move outside
- Refuse with no specific reason, or with religious reason

## Environmental Compliance

A full Environmental Compliance Report is included as an annex to this report, and can be obtained electronically from RTI.

## Cost Analysis

The fully loaded program costs in-country for Malawi through the end of the mop-up round are \$557,045. This includes the SEA and other environmental compliance costs, procurement, in-country management costs, trainings, technical assistance visits, etc. Applying this figure to the total of all households sprayed yields a cost per household of \$19.73. Since the Dwangwa Sugar Estates sprayed their own households it is reasonable to exclude their 3,450 households and the cost of their pesticide from the equation. PMI provided the Estates with 2,000 sachets of insecticide and technical collaboration. The number of households sprayed by the NMCP/DHMT crews totals 24,777 (23,450 in the



main round and 1,327 during the mop-up round). This yields a per household cost of around \$22.

RTI is conducting a more in depth analysis of the costs of the Malawi spray round, disaggregating by cost elements (e.g. labor, transportation, commodities, communications, technical assistance, etc.). This will be shared upon completion.

## End of Round Lessons Learned

### Lessons Learned

There are many lessons to be learned from the Nkhotakota spray operation. Firstly, the late start and rushed start-up in Nkhotakota was detrimental to smooth operations. Additionally, the program learned that no IRS program should proceed without a Chief of Party in place. Other lessons include:

- Support provided by district and community leaders was invaluable. Where there were problems, such as a locked house, community leaders were always helpful in finding out the reasons and giving the householders an opportunity to have the premises sprayed. Chiefs and village volunteers worked hand-in-hand with spray operators throughout the spraying exercise in their respective villages. Although there was very limited remuneration to these leaders, this was not a barrier. The working spirit was geared towards spraying all houses in their locations.
- The role of women in accelerating community development was clearly observed in the IRS program. IRS is a tough field activity. Community acceptance of women as spray operators enhanced coverage.
- Although information campaigns were carried out, it was observed that some household clusters were not reached and therefore missed important IRS messages. This was clearly confirmed by spray operators finding inadequate household preparation. In turn the operators had to support families before actual spraying is taking place. Complete IEC and Community Mobilization coverage is essential—but operators should be trained for this as it can happen in any campaign.
- This spray operation did not use Household Stickers (small, uniquely numbered stickers attached to the main building of a HH indicating when it was visited, spray status, and other information. The absence of stickers made data recording more difficult, contributed to inaccuracies in HH count, and complicated both routine spray coverage as well as the mop-up round. Household Stickers should be used in all spray operations.
- Team Leaders and Supervisors should be chosen with care from the best of the trainees based on performance and suitability to the role. In Nkhotakota some Team Leaders and Supervisors were chosen based on other criteria and did not

- For the average Malawi citizen, distinguishing mosquito morphology and behavior is a rare phenomenon. Culex mosquitoes proliferated following the rains and Culex appear to be resistant to lambda-cyhalothrin. Community members have low confidence in ICON based on the behavior of Culex. This was discussed freely and frequently by community members after seeing mosquitoes flying around in spite of indoor residual house spraying. This calls for more educational programs to the community to develop understanding of malaria and its prevention so that their participation in future programs is maintained.
- Misinformation was spread by two sources in this operation. At least one trainee who had been released for poor performance engaged in spreading rumors that ICON would cause sterility. Also some inaccurate information was given out by trained IEC mobilizers at the beginning of the spray round concerning toxicity and safety of lambda-cyhalothrin. The lessons are: assure and maintain quality of training; provide supervision and be ready to intervene and correct; and communicate early, often and thoroughly. Swift intervention on the part of the District IRS team prevented this problem from continuing.
- Adequate time is required for organizing proper IRS implementation; this includes environmental assessment, planning, monitoring and implementation in order to fully capture all necessary steps before getting to the field.
- Training should be thorough and of sufficient duration. While the training program was diligent about separating operators who were not up to standard, the operators who were up to standard, and the program generally, would have benefitted from longer training and team building.
- Distribution or provision of fuel is a highly contentious issue. Time was lost to arguments about this. The project should be firm and fair, and not hesitate to dismiss drivers who create unjustified problems over fuel.
- The utilization of community mobilizers and village health volunteers has a significant positive impact on uptake and acceptance of IRS within the community.
- Community criers proved effective and contributed to smooth operations and should continue to be utilized.

# Annex 1

## IRS FIELD SUPERVISION CHECKLIST

DISTRICT: NKHOTAKOTA

Sector: \_\_\_\_\_ Village: \_\_\_\_\_

Supervisor/team leader \_\_\_\_\_ Number of Spray Operator \_\_\_\_\_

Name of the household owner being sprayed:.....

Name of Team Leader.....

What was he/she doing on your arrival?.....

Observe the use of Personal Protective Equipment (PPE):

Overall \_\_\_\_\_ Boots \_\_\_\_\_ Mouth/NoseMask \_\_\_\_\_

Faceshield \_\_\_\_\_ Gloves \_\_\_\_\_ Helmet/Hat \_\_\_\_\_

### PROCEDURE BEFORE STARTING TO SPRAY:

Inhabitants informed about spraying?	Yes	No	
The house was thoroughly inspected by operator?	Yes	No	
Are food items, water containers, cooking utensils covered/taken outside?	Yes	No	
Are the inhabitants outside during spraying and after?	Yes	No	
Is domestic animal/s outside during spraying and after?	Yes	No	
Is the sprayer shaken periodically before and during spraying?	Yes	No	
Is the nozzle held at a constant distance from the target (45cm?)	Yes	No	
Are adjacent swaths overlapped for uniform spray coverage?	Yes	No	
Is the operator maintaining the right speed and consistency?	Yes	No	
Is the operational spray pressure regularly checked?	Yes	No	
Is the pressure released when the sprayer is not in use?	Yes	No	
Distribution of insecticide on wall	Poor	Good	Very good
Distribution of Insecticide on ceiling	Poor	Good	Very good
Does spray operator spray behind the doors?	Yes	No	
Does spray operator spray behind immovable furniture?	Yes	No	
Does spray operator avoid environmental pollution?	Yes	No	
Does spray operator eat/drink during exercise?	Yes	No	
Does spray operator eat/drink without first washing?	Yes	No	
Does spray operator fill the daily record form properly?	Yes	No	

### OTHER OBSERVATION; e.g.

spillage?.....

## Annex 2

### Inventory of Pumps, Parts, Hardware, PPE procured for Spray Operations<sup>1</sup>

Description	Amount originally procured	Amount in stock May 08
Hudson sprayer	130	127
Icon 10% CS	19200 + 2500	1427
Nozzles 8002E	365	365
Cover gasket	200	200
Inline strainers	1,400	1375
Plunger adaptor	600	466
Service Parts Kits	13	13
Helmets	224	220
Cap head gear	100	14
Face Shields	165	162
Chest vest	90	86
Respiratory mask	5,280	2725
Hard rubber gloves	660	47
Overalls	561	527
Safety goggles	145	106
Screwdrivers	5	5
Shifting spanners	5	5
Pliers	4	4
Heavy Duty spanners	3	3
Knives	3	3
Hudson Manuals	114	114
Taps (water)	8	8
Fire extinguisher	1	1
Metal Stands	13	13
wooden pallets	4	4
Large basins	50	48
Big Buckets	60	57
Small buckets	30	30
Plastic chairs	16	16
Room thermometer	2	2
Wall Fans	2	2
Ceiling Fan	1	1

<sup>1</sup> Does not include office supplies, soaps, or other disposable inventory.

## Annex 3

### Exit Medical Report for Insecticide Spraying Team in Nkhotakota North

Submitted by Dr. Henry H.Z. Chakaniza, Dwangwa  
December 2007

#### **Introduction**

The resident management of RTI International (Malawi) who were working in Dwangwa asked me to interview and examine all the staff that were involved in the spraying program to assess if any had significant medical findings as a result of exposure to the Lambda-cyhalothrin (Icon) which they were using during the In-door Residual Spraying Program that was held in Nkhotakota North.

#### **Methods**

All staff were invited in a consultation room where they had an interview with a clinician. They were asked to report all adverse experiences they had during the period of spraying. They also reported if the symptoms were still present or had disappeared. Any person who had existing complaints at the time of the interview was examined and an objective opinion was formed. In the case where the clinician was uncertain the complainant was referred to the doctor for final determination of the symptom or sign and a determination was made as to whether it was likely to have been caused by the insecticide they worked with.

#### **Results**

Two hundred and ten staff members doing different tasks were examined out of which two hundred and fourteen (214) complaints were raised. Those deemed to be related to Icon were classified as occupational while any incidental symptoms were classified as non occupational. Those needing treatment were recorded. Treatment was given regardless of the cause of the signs on the same day.

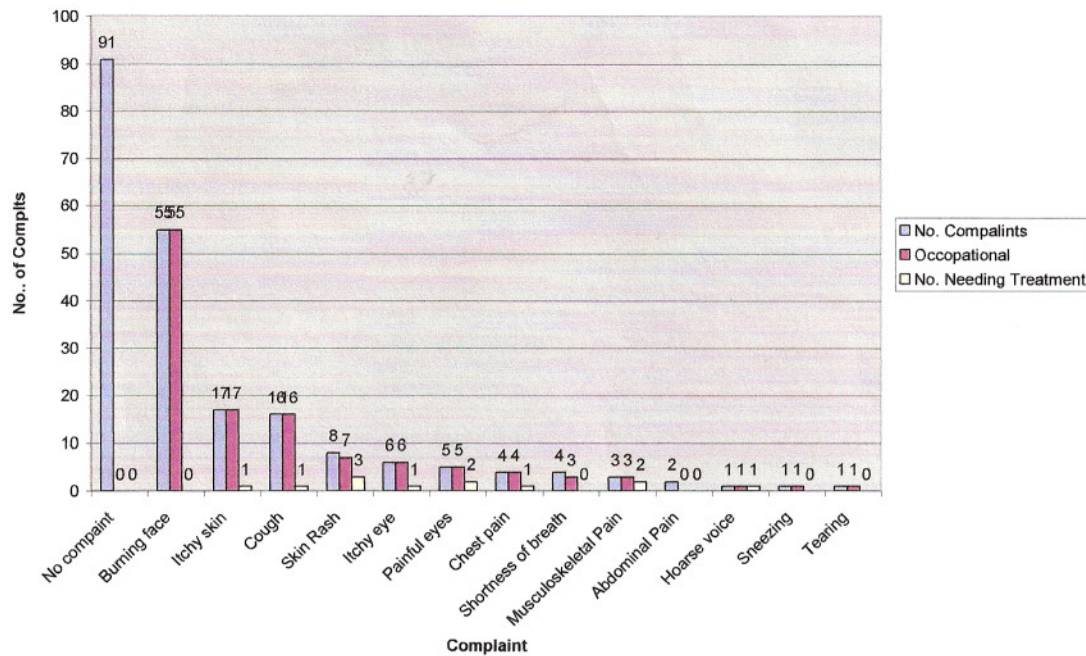
Over forty percent (91 people) raised no complaint. The remainder raised various complaints most of which were known but temporary effects of Lambda-cyhalothrin. Most of them resolve spontaneously and are avoidable when good safety and hygiene measures are followed. A total of twelve (12) people needed treatment representing 5.6% of the total that presented themselves. Among them one person had a bacterial infection no related to the insecticide at all. The commonest complaint was burning sensation on the face. No one needed treatment for this as it resolved very quickly by itself. Among the seven people with skin rashes in various parts of the body, three needed treatment while two of the five people with painful eyes were given treatment.

### Summary of results

Symptom	No. of Complaints	Occupational	% of Population	No. Needing Treatment	% Needing Treatment
Nil complaint	91	0	42.5	0	0
Burning face	55	55	25.7	0	0
Itchy skin	17	17	7.9	1	5.9
Cough	16	16	7.5	1	6.3
Skin Rash	8	7	3.7	3	37.5
Itchy eye	6	6	2.8	1	16.7
Painful eyes	5	5	2.3	2	40
Chest pain	4	4	1.9	1	25
Shortness of breath	4	3	1.9	0	0
Musculoskeletal Pain	3	3	1.4	2	66.7
Abdominal Pain	2	0	0.9	0	0
Hoarse voice	1	1	0.5	1	100
Sneezing	1	1	0.5	0	0
Tearing	1	1	0.5	0	0
<b>TOTAL</b>	<b>214</b>	<b>119</b>	<b>100</b>	<b>12</b>	<b>5.6</b>

Below is the graphical presentation of some of the most important data

**Staff Complaints**



**Discussion**

Close to sixty percent of the people working with icon raised complaints. The complaints were however well known and documented reversible effects of Icon. The few that needed treatment had current exposure and therefore the symptoms needed to be treated on the spot. Otherwise people with similar symptoms had spontaneous resolution before the clinic day. None of the staff members needed hospitalization and all left in good physical fitness.

Based on the finding above I am happy to report that the staff members that I examined exited from the project with no permanent medical conditions or incapacitation as a result of working with Icon (Lambda-cyhalothrin)

**Reported by Dr. Henry H.Z. Chakaniza**

**Signed::** \_\_\_\_\_



**Dwangwa**

**DATE: 27<sup>th</sup> December 2007**