INDOOR RESIDUAL SPRAYING FOR MALARIA CONTROL

Rwanda Spraying Performance Report

Indoor Residual Spraying (IRS) Indefinite Quantity Contract (IQC)

December 2007

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

Prepared for:
Rwanda Mission
United States Agency for International Development

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

Country Background

Rwanda was identified by USAID as one of the second 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 Rwanda National Malaria Control Program (PNILP) identified three epidemic-prone districts (Kicukiro, Nyarugenge and Gasabo) for indoor residual spraying (IRS) activities. In 2007, USAID and the PNILP agreed to focus spraying activities in Kigali with the intention of expanding IRS coverage to Nyanza and Kirehe in 2008.

RTI is tasked with providing strategic, technical, management, and operations support for IRS activities in the above mentioned districts. RTI and the PNILP will treat at least 145,000 households with residual insecticide and protect 700,000 people in three districts during the first round of IRS. This will protect approximately 145,000 households and at least 85 percent of the total estimated population in the targeted districts.

In addition, RTI will develop and implement a second round of spraying in Rwanda in collaboration with Rwanda's Ministry of Health (MOH), as well as provide support to the PNILP to strengthen epidemic preparedness and response plans.

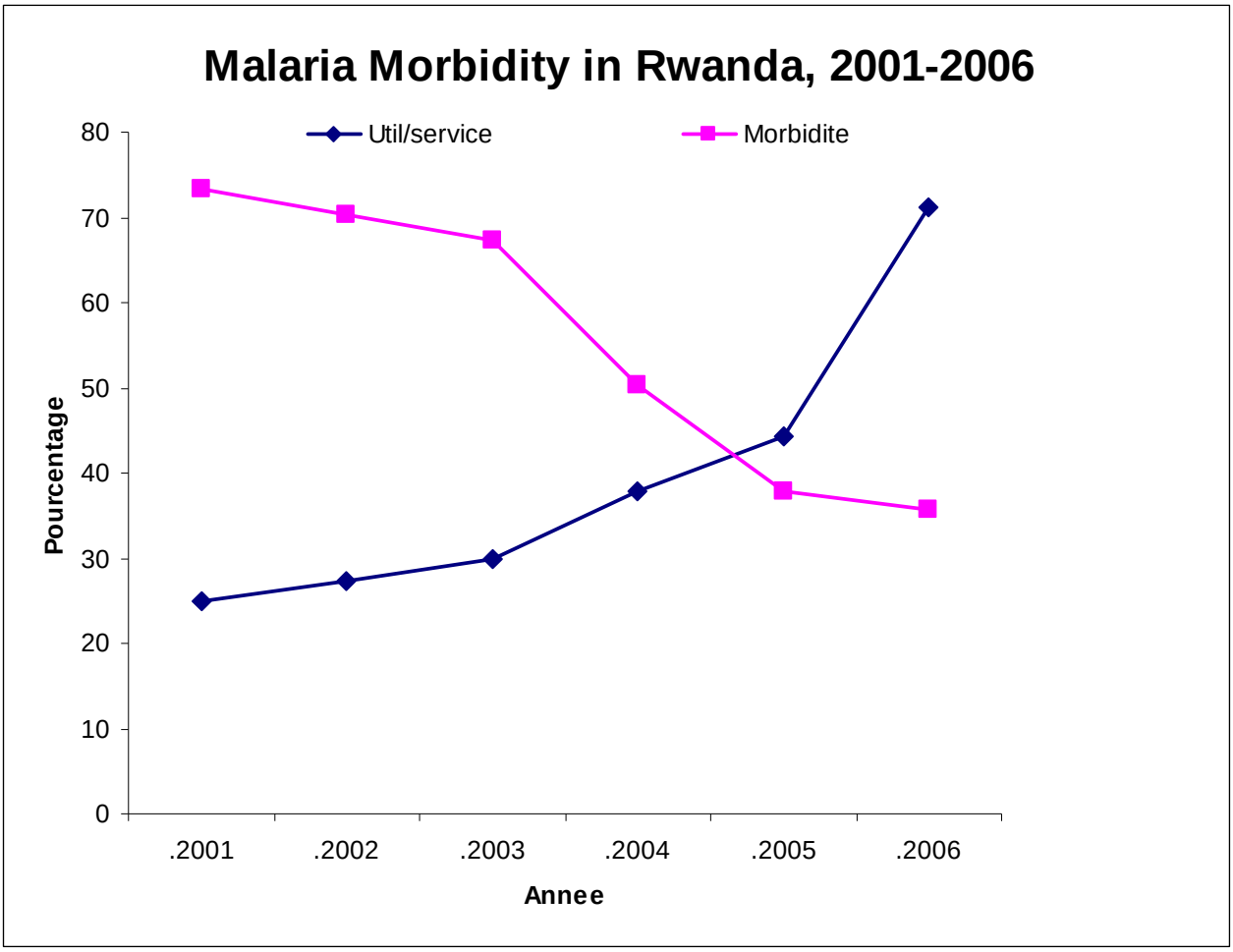
This monthly report presents the program's progress towards achieving these objectives in Rwanda and summarizes the project's current activities and achievements, outstanding issues, and upcoming activities.

Malaria Situation in Rwanda

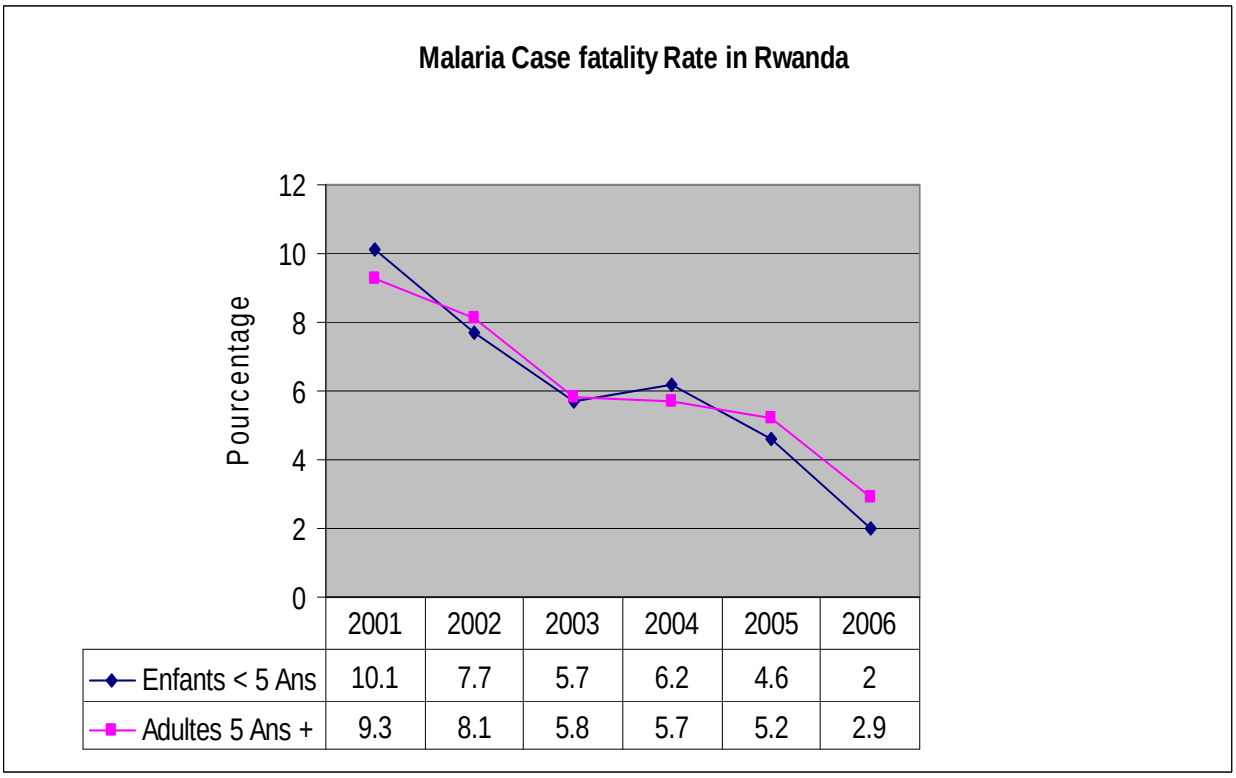
Geographically, malaria transmission in Rwanda has increased over the last ten years for many reasons. The increase in transmission may be attributed to increased chloroquine resistance (previously the most common form of malaria treatment), greater population density and population movements, and human and economic activities, such as rice farming, brick making and mining. All of these activities increase breeding areas for mosquitoes and thus increase the risk of malaria transmission. Malaria is now evident in high altitude areas and other areas where the disease was not previously a public health problem. Often, inhabitants of these areas have little or no immunity to the disease and are therefore prone to severe forms of malaria. Since 1998, severe epidemics/upsurges of malaria have been observed nationwide almost every two years.

Health facility data show that malaria is the overall leading cause of morbidity and mortality in Rwanda, responsible for up to 50 percent of outpatient attendance. More than 1.2 million cases of uncomplicated malaria were treated in public sector health centers during 2004. In 2005, this figure increased to over 1.5 million. However, this number significantly under-represents the total number of annual episodes in the population, since only 32 percent of the population utilized health services during the same period. It is difficult to determine whether the growth in case loads is more attributable to the increase in malaria transmission levels or whether it is due to effective behavior change communication (BCC) campaigns and community health insurance schemes that have created greater demand for health services (Rwandan PMI's MOP, 2007).

Figure1.



Source: *National Malaria Control Program*



	2001	2002	2003	2004	2005	2006
Enfants < 5 Ans	10.1	7.7	5.7	6.2	4.6	2
Adultes 5 Ans +	9.3	8.1	5.8	5.7	5.2	2.9

Source*: National Malaria Control Program*

Plasmodium falciparum is the main plasmodium species encountered in Rwanda with 95 percent of malaria cases, followed by *Plasmodium malariae* (4.5 percent of cases) and *Plasmodium ovale (*.5 percent of cases). For several years *P. falciparum* is increasingly resistant to anti malaria drugs.

Several entomological studies performed since 1942 indicate that *Anopheles gambiae* and *A. funestus* are the main vectors responsible of malaria transmission in Rwanda. Susceptibility tests performed on *A. gambiae* strains that were collected in the district of Kacyiru indicate good susceptibility to deltamethrin .05 percent with mortality rate comprised between 80 percent and 98 percent.

Malaria is not properly treated in many health care facilities as well as at home while the level of use of preventive methods (ITN, LLIN, larval treatment, IRS) is still very low (PNILP, 2005). The 2005 Demographic and Health Survey (DHS) conducted between February and July of 2005 showed weak case management practices for malaria in children under 5. Among caregivers who reported having a child with fever in the two weeks before the survey, only 12.3 percent of children received an anti-malarial drug and only 2.5 percent had received treatment within 24 hours. In addition, only four to six percent of those children were given a recommended drug (combination amodiaquine-sulfadoxine-pyrimethamine (AQ/SP) or quinine). In three districts studied in 2005, only 21 percent of persons with uncomplicated malaria and 44 percent of patients with severe malaria were managed correctly in health facilities, and only 59 percent received a recommended drug.

Use of preventive measures at the household level is also inadequate. Rwanda experienced modest gains in ITN ownership between 2000 and 2005, but coverage remains relatively low. Overall ITN coverage increased from 6.6 percent to 14.7 percent, use by children under 5 rose from 4.3 percent to 13.0 percent, and use by all women rose from 3.9 percent to 10.5 percent. In 2005, 17.2 percent of pregnant women slept under an ITN (not queried in 2000 DHS). The 2005 DHS found only 18.2 percent of households with at least one net of any type, and only 14.7 percent with at least one ITN.

From a socioeconomic standpoint, a study in Rwanda calculated that 19 percent of the country's health budget was consumed by malaria treatment in public health facilities (WEF, 2006), that 16 percent of all donor health funds, 13 percent of all public health funds, and 26 percent of all private health funds went towards malaria efforts, and the direct cost per episode of malaria treated is estimated to be $2.09 while the indirect cost is over $5.00 (MOP, 2006). With the majority of children and many adults experiencing more than one episode per year, malaria impedes economic development. Donors (38 percent), followed by households (29 percent), and lastly public sources (24 percent) are the main financiers of malaria services (Carlson A. & Al., 2007); hence households spend more than the government for malaria (contrary to general health care). According to the same source, overall resources for malaria are spent on curative care rather than preventive and public health programs.

In such a context, malaria will make worse the prevailing high poverty level in Rwanda; over 60 percent of individuals live in poverty, 42 percent in absolute poverty and 57 percent of households live below the poverty line (UNDP Rwanda). Such a poverty level is aggravating the impacts of malaria epidemics on public health.

Justification for IRS in Kigali City's Districts of Gasabo, Kicukiro and Nyarugenge

In recent years, a series of malaria epidemics have occurred in Rwanda. These epidemics resulted in high mortality and serious socio-economic consequences. Some of these epidemics were partially controlled using IRS with ICON™ 10 percent WP (Malaria Control Program Reports). However, the program felt that the magnitude and impact of these epidemics could have been minimized if they could have been forecasted and control measures (including IRS) had been used as a prevention measure on a larger scale.
The major malaria vectors in Rwanda, *Anopheles gambiae s.l.* and *An. Funestus,* are both highly endophagic and endophilic (they feed and rest indoors). They are amenable to IRS because of their behavior. There is therefore a need to establish an IRS system in malaria epidemic-prone districts. The greater impact will be seen as a decrease in malaria case loads after IRS and higher public acceptance for spraying, as well as the fact that the PNILP is now keen on conducting larger-scale, well-targeted IRS campaigns in unstable transmission areas.

Basis for using Lambda -Cyhalothrin Insecticide for this IRS Program

The PNILP initially proposed two insecticides for IRS: lambda-cyhalothrin and bifenthrin. Vectors within Rwanda are susceptible to both lambda-cyhalothrin and bifenthrin, although during the field trials communities preferred bifenthrin because of its less irritating effect on the skin. Both products are comparable in price and product support, based on communication with Balton CP and RTI purchase records for ICON. Based on meetings with the PNILP and Balton CP, as well as communication with RTI IRS Technical Advisor John Chimumbwa, the team indicated that Bifenthrin (Bistar 10 WP) is an inappropriate product for large-scale residential IRS in Rwanda. Balton CP field trials in Uganda indicated that Bifenthrin was effective for approximately three months on mud walls. Since the spray season lasts two months and the peak malaria transmission seasons in Kigali last approximately three to four months following commencement of the rainy season, the residual life of Bifenthrin is inadequate to protect the population throughout the malaria transmission season.

Lambda-cyhalothrin is a more appropriate insecticide when considering the long-lasting effects of the insecticide. Based on field trials conducted by Brian Sharp in South Africa and the Institute Pasteur in Madagascar, lambda-cyhalothrin is effective on mud walls for at least five months. Wall bioassays will be conducted during and after the IRS campaign to concretely determine that the residual effect of ICON is appropriate for Rwanda, given the climatic conditions within the country.

In addition to this, ICON WP is one of the insecticides registered in Rwanda which has also been in use in agriculture with different concentration. It has also been acceptable by the National Malaria Control Program as a pyrethroid pesticide to be used in IRS. Lambda Cyhalothrin (ICON WP) has been approved by the WHO for use in IRS and, according to USAID's Integrated Vector Management for Malaria Control: Programmatic Environment assessment, ICON WP poses a low health risk to both spray operators and resident beneficiaries of the IRS Program.

Operations

IEC Activities and Community Mobilization on IRS Project

The following activities were implemented to ensure appropriate community mobilization on the IRS project:

- 60 IEC implementers were trained for IRS work at the village (Umudugudu) level;
- 40,000 brochures were distributed during community work (Umuganda);
- A total of 120,000 information sheets were distributed during Umuganda day and various local leaders meetings;
- 1,500 folders containing IRS messages were distributed on IRS launch day on August 10;
- 500 T-shirts distributed on IRS launch day;
- 7 cloth and digital banners were mounted in different strategic areas of the three districts of Gasabo, Kicukiro and Nyarugenge.

Storage Facility Requirements and Transportation of Spray Teams

ICON WP and other IRS-related items were delivered and stored in secure storage facilities in all sectors. Throughout the operation, there were constant supervisory visits by the COP and the logistics officer to district and sector stores for environmental compliance, as well as sector operation sites for inspection of ICON use and other related IRS consumables and materials.

Arrangements were made for smooth transport of sprayers and other IRS personnel in all 35 sectors of the three districts. Empty sachets of ICON WP were tracked, collected, and returned empty to the central store in Kicukiro (Nyarugunga) from all sectors. No single sachet of ICON went missing throughout the operation.

Environmental Impact Assessment

Oversight of environmental compliance at different sites continued through field visits by the COP. These visits were in addition to daily surveillance by environmental health officers deployed to each sector who worked hand in hand with IRS supervisors and sector managers. Dr. Jacob Williams from RTI Washington, D.C. paid a post-IRS visit during October 2007 to monitor environmental compliance, check IRS site conditions, and ensure good practices. By the time of his visit, soak pits were being improved to make them smaller. It was indicated that most of the reported allergies were caused by wet mopping of the floors with unprotected hands after houses had been sprayed, and it was suggested that more education on this was needed before the second spray round. Dr Jacob Williams visited 21 out of 35 sites and also met National Malaria Control Program and USAID officials. It was reported that coordination of the operation went well.

Entomological Monitoring

Dr. Lassana Konate, a consultant, carried out a post-IRS surveillance study by collecting mosquitoes in three sprayed districts. Mosquitoes were collected from two villages in each district and from inside and outside the sprayed houses. Lack of insectaries limited Dr. Konate's work. His study indicated fewer and sometimes no anopheles mosquitoes in the samples collected from different sites. He recommended monthly monitoring of the effectiveness of ICON on walls. Baseline entomological studies were carried out in Nyanza and Kirehe by Emmanuel Hakizimana of the National Malaria Control Program (PNILP). Sentinel sites increased from 10 to 19 countrywide. Dr. Lassana provided a draft report to both USAID and RTI.

Implementation of IRS Activities

IRS was officially launched on Friday, August 10 at Cyeru village primary school in the Mbandazi Cell, Rusororo sector, Gasabo district. Dr. Innocent Nyaruhirira, the Minister of State in-charge of HIV/AIDS and other epidemics, officially launched IRS by spraying a resident's house in Cyeru village, assisted by United States' Ambassador to Rwanda, His Excellency Michael Arietti. The ceremony began with welcome remarks by the Vice Mayor of Gasabo district, who welcomed the Vice Mayor of Kigali City. The Vice Mayor, Hon. Jeanne Gakuba, gave a speech on behalf of the City Mayor, Dr, Aisa Kirabo Kakira. This was followed by the U.S. Ambassador's speech, which focused mainly on the U.S. government's continued commitment to support the Rwandan government in its campaign against malaria. In his launch speech, Minister Nyaruhirira reminded residents of Kigali city that malaria was the number one killer disease and that we must all collaborate to get rid of it. He requested every resident of Kigali city to cooperate and open up their houses for sprayers in order to

make this campaign a success. He thanked the U.S. government's financial and technical support to this campaign through the President's Malaria Initiative. He informed Rwandans that this was one of the interventions in the fight against malaria and that IRS was not being introduced to replace existing interventions in malaria prevention (like insecticide-treated bed nets), but that IRS is being introduced to supplement other interventions. The launching ceremony was attended by different dignitaries from the American embassy and USAID, notably Karen Shelley, John Dunlop, and Dr. Patrick Condo, the Twubakane project, and the World Health Organization. RTI International was represented by the task manager for Rwanda, Ms. Anna Thompson, and Dr. Jacob Williams from Washington, D.C. The ceremony was also attended by Dr. John Ndungu from Syngenta Nairobi; Dr. Josephat Shilulu, ICIPE Nairobi; residents of Rusororo sector; and officials from Gasabo district. The launching ceremony was also attended by a team of sprayers from Rusororo sector and RTI staff at program and district levels. The ceremony was graced by a performance on IRS by Mashirika Theatre Troupe.

IRS operations commenced in all three districts on Monday, August 13. All operations were done at the sector level, and spraying began with buffer zones bordering wetlands and swamps in the valleys, where most of the poor live, and progressed towards residential areas on hillsides and gradually to the tops of hills. There was abundant collaboration with local leaders in sensitization of the communities to allow sprayers in their houses. IEC implementers passed messages to members of the households one day before the spraying, informing them to remove food, water, and other moveable household items from their houses, cover items that cannot be removed, and stay out of the house at least two hours after the spraying. They were also informed on how to sweep and clean the house after the spraying, throw away dead insects into pit-latrines to protect chicken, ducks and other domesticated birds from eating them, and how to prevent children and pets from moving into the house before the required time has passed. IRS public sensitization messages were aired on popular FM radio stations through announcements, spots, call-in and talk shows, and house-to-house visits by supervisors and team leaders.

Data cards were filled by spray operators, team leaders and supervisors. Sprayers used a white card on which the following details were recorded: name of district, sector, cell and village, number of ICON sachets given, number used, number of remaining sachets, number of returned empty sachets, name of sprayer, team number, and signature. Data recorded on this card includes: type of house sprayed, total number of rooms, number of sprayed rooms, number of unsprayed rooms and reasons for not being sprayed, number of people in the household by age and sex, whether or not there is a pregnant woman in the household, number of insecticide-treated bed nets, number of untreated bed nets, number of children under the age of five, and the number of pregnant women using treated bed nets. Other details included reasons for refusals, locked doors and whether or not the house had a food store. This card was counter-signed by the team leader.

Team leaders used a yellow card with the following details, in addition to the physical address: the name of sprayer, type of house, number of sprayed houses, number of sprayed rooms, reasons for not being sprayed, number of people in the house hold, bed nets (treated and non-treated), pregnant women and children under the age of five who use treated bed nets, number of issued ICON sachets, and the number of empty and unused sachets that were returned.

Supervisors used a pink form with similar details to those of the team leader, and both had to give their views on how the operation was implemented at the end of the day.

Rwanda IRS Program launching (August 13th,2007)

IRS Results

Spraying was carried out from August 13th to October 13th 2007. The approximate populations listed for each district are Kicukiro: 42875; Nyarugenge: 43679; and Gasabo: 65208.

The program was successfully implemented, yielding a much higher coverage rate of 106.7 percent for the spray activities in the planned period of time. The number of households targeted was 151,762. The number of households reached was 163,543 with 161,996 households sprayed. The total number of females (and/or pregnant women) protected was 16,518. Total number of children under the age of five protected was 123,955. The refusal rate was 0.9% because of rumors about ICON. The number of households which refused IRS in Kicukiro were 429, in Gasabo, 1,018, and in Nyarugenge, 100.

Equipment:

Insecticides: The proposed insecticide for this program was ICON-10 percent WP ™. According to the estimates of the total sprayable surface in the average house, one sachet (62.5 grams) was estimated to cover approx. 1.75 houses. To protect 155,700 homes, it was estimated that 5,560 kg would be required.

Spray pumps: RTI used WHO-approved Hudson X-Pert® compression sprayers for the IRS. Six hundred spray pumps were estimated to be needed for the first round, and an additional 350 for the second round (for five districts by January 2008).

Toolkit: A toolkit for repair maintenance of sprayers was provided to each spray unit, including:

- Pliers
- Adjustable wrench
- Screw driver
- Knife

A total number of 35 toolkits were delivered (one toolkit per sector).

Personal protection equipment: During the first round of IRS operation in the three districts of Kigali City, each spray operator and team leader was provided with the following protective equipment (PPE), in accordance with WHO specifications:

- Khaki overalls (two per operator for washing rotation)
- Helmet and face shield
- Mouth/nose mask
- Hard rubber gloves
- Rubber boots (one pair per operator)

The following safety gear and equipment were provided to suit-washing personnel at each washing site in all sectors:

- Aprons
- Nose/mouth mask
- Rubber gloves
- Rubber boots
- Soap
- Bathing sheds for sprayers

The following items were also provided to spray operators and to washing sites:

- Bags for team leaders to carry insecticides/other equipment
- Barrels for each sector for progressive rinsing
- Data forms to fill out after spraying each house

Warehouse and Use

The National Drugs Authority has regulations on the storage of medicines, but not of insecticides. Camerwa (Centrale d'Achats des Médicaments Essentiels du Rwanda, or Essential Drugs Purchasing Group) was consulted and chosen as the best qualified agency to support the project in storing pesticides for use in the three Kigali districts. RTI International staff from both the Washington, D.C. and Nairobi offices visited and approved Camerwa's storage facilities. USAID personnel from the USAID/Kigali office also visited and approved the facilities. Insecticide used in previous NIMCP – BTC IRS campaigns was also stored in these facilities. In the other two districts, officials confirmed the availability of warehouses that will be used to store the products and expressed willingness to support the project to that end.

Safety

In normal circumstances, lambda cyhalothrin presents a small risk to human beings and the environment if user guidelines are adhered to. Dermal and inhalational exposures usually have mild or no adverse effects. Substantial ingestion may lead to a coma, convulsions, and severe muscle fasciculation. It may take several days, and occasionally weeks, to recover (PNILP: 2007).

Common side effects encountered in the three districts of Kigali city were mainly eye irritation and dermal corrosion due to exposure. All reported cases were referred to district hospitals, health centers or private polyclinics.

The table below shows the number of cases encountered in the three districts during the campaign.

Table: 6

No.	Details of Symptoms	Gasabo	Kicukiro	Nyarugenge	Total
1	Dizziness	7	8	3	18
2	Dermal Corrosion	56	79	17	152
3	Eye Irritation	46	67	20	133
4	Headache	20	59	6	85
5	Hand Tremor	2	0	0	2
6	Nausea/vomiting	8	11	1	20
7.	Convulsion	0	0	0	0
8	Coma	0	0	0	0
9	Staggering	0	1	0	1
10	Death	0	0	0	0
11	Rush	7	11	4	22
12	Other	1	4	2	7
	Grand Total	**147**	**240**	**53**	**440**

Costs

OPERATIONS	Mar	Apr	May	June	July	August	September	
								TOTAL (RWF)
Salaries and wages					789,362.00	41,499,182	115,151,395	**157,439,939**
Telephone & internet (closed user group for 60 pers.)				202,000	4,941,393.00	3,981,900	2,543,151	**11,668,444**
Entomologist					1,345,800.00	969,860		**2,315,660**
Food costs for spray teams						4,200,000	31,588,800	**35,788,800**
Operations Water supply (break-up)					**157,500.00**	**1,154,000**	**3,921,270**	**5,232,770**
IEC campaign for IRS					974,100.00	9,163,664	3,473,468	**13,611,232**
Soak pits						17,000	8,074,300	**8,091,300**
Medical screening costs and curative treatment						9,807,000	1,749,600	**11,556,600**
Vehicle hire					628,000.00	46,039,000	50,522,800	**97,189,800**
Computer renting						160,000	3,250,000	**3,410,000**
Training costs					9,955,500.00	31,762,640	2,134,700	**43,852,840**
Spraying costs & materials						7,632,450	6,403,850	**14,036,300**
Administration	14.98	5.3	2	432,167	1,582,878.30	3,646,387.02	2,979,849.02	**8,641,304**
Office rental				4,400		4,914,600	100,000	**5,019,000**
Duplication cost					67,600.00	224,080	669,000	**960,680**
Office equipment cost					4,974,880.00	3,645,256	165,000	**8,785,136**
TOTAL	**14.98**	**5.30**	**2**	**638,567**	**25,417,013.30**	**168,817,019.02**	**232,727,183.02**	**427,599,804.62**

Human Resources Requirements

In addition to administrative support personnel, the proposed two-month spraying program required a total of 600 full-time spray operators (including team leaders and supervisors) for the initial three districts and 950 when the program increased to five districts in January 2008. In order to complete the first round of spraying (three districts) in two months, especially considering the terrain in the districts and lack of road access to many communities, it was deemed necessary to have 35 independent field operations (one per sector). 560 personnel were directly involved in spray operations, with an additional 70 people involved in the information, education and communications (IEC) campaign. Spray teams consisted of eight spray operators and one team leader. Team leaders were selected from best spraying trainees and were entrusted with supervisory roles and responsibilities and to provide information on IRS and answer questions from the public.

The selection and recruitment of spray operators was the responsibility of the respective sectors. This approach was aimed at building capacity at the sector level and allowing a sense of ownership in order to sustain future IRS campaigns.

Medical check-ups were conducted for all IRS operators to determine their physical fitness before the start of IRS operations and pregnancy tests were carried out for all women sprayers.

Spray and IEC operations in each sector were planned on a weekly basis and the spraying program was published in the newspaper for the people to be aware of spray dates for their respective localities. Planning was done at district level by sector managers and district operations managers. Environmental compliance was supervised and monitored on a daily basis by environmental health officers deployed by the National Malaria Control Program to each sector working hand-in-hand with IRS sector managers and supervisors.

Table 1: Human Resources Requirement for Round I (Three Districts)

Category	Number
Country Manager	1
Spray Operators	499
Team Leaders	62
Team Supervisors	21
District Coordinators	3
Sector Site Managers	35
Logistics Support	39
Admin Support	6
Security	35
IEC Personnel	52
Total	**753**

Timing for IRS Implementation

During the assessment trip, the PNILP proposed changing the timing of spraying from July-August 2007 to April-May 2007. This proposed change was not feasible due to the high rainfall in April and May, as evidenced by meteorological data provided by the Rwanda Meteorological Services (see Table below). Additionally, pre-emptive spraying for malaria, based on meteorological data, should be conducted in July and August, just prior to the short rains. IRS timing was based on these facts, and spraying started on August 13, after the official launch on August 10. This was done after preparatory activities, such as recruitment of IRS program staff; selection and training of sprayer operators, sector managers, sector supervisors, and IEC implementers; and dissemination of IRS messages to the public through FM radio stations and national television. Office, storage facilities, and washing sites were also identified and secured at sector levels.

Table 2. Kigali Monthly Precipitation (mm)

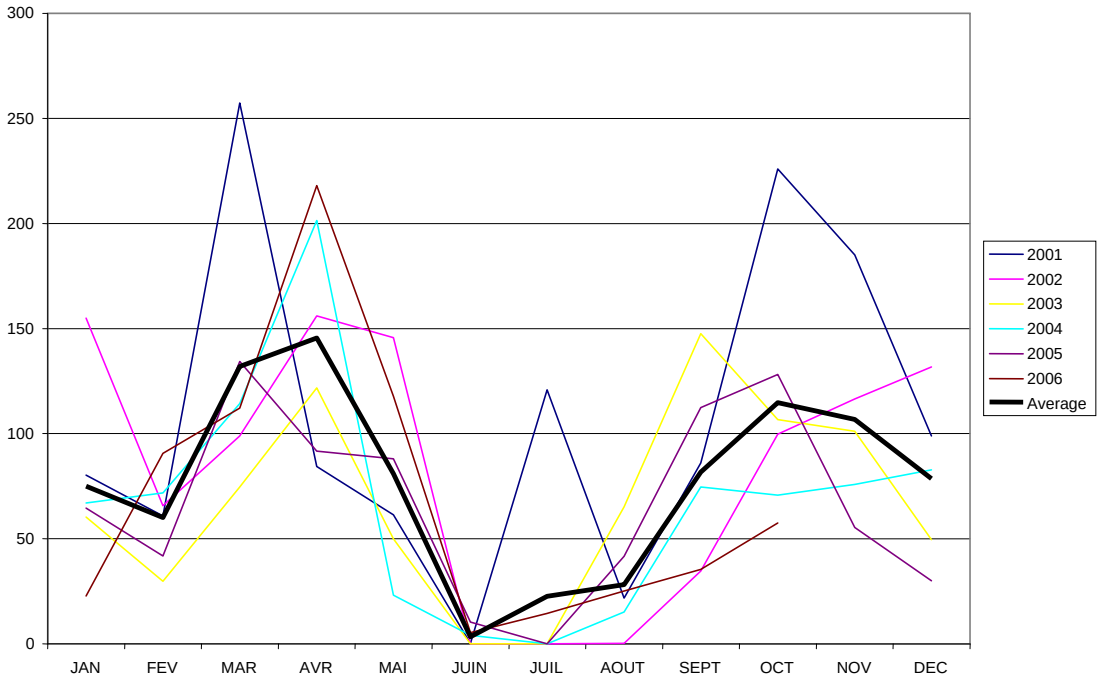


Table 3: Initial Activities and Timeline Planned for 1st Round of IRS program in Rwanda

Activity	Dec 2006	Jan 2007	Feb 2007	Mar 2007	April 2007	May 2007	June 2007	July 2007	Aug 2007	Sept 2007
Environmental Assessment										
Logistics Assessment										
Partner Meetings										
Micro planning										
Logistics arrangements										
Development of IEC material/message										
Pre-testing IEC materials/messages										
Production of IEC material										

Preparations for training courses										
TOT (supervisors/team leaders)										
Spray Operators and IEC personnel training										
Preparations for geographical reconnaissance										
Baseline ento: survey										
IEC campaigns										
Environmental/ecological monitoring										
Spraying operations										
Geographical reconnaissance										
Field supervision										
GR data entry compilation										
Post entro: survey										
Report preparation										

Procurement of IRS insecticide, PPE and other materials

Crown Agents procured and delivered 5,500 kg of ICON WP, protective equipment and gear, and pregnancy test kits between July 4 -16. By the end of July, all materials had been cleared with customs and were stocked in the CAMERWA warehouse to be ready for distribution to sector storage facilities before spray operations.

Table 4. List of Procured Materials.

LOT	VENDOR	DESCRIPTION	QUANTITY	U/M
A	Syngenta	Icon 10WP, 100gm ai/kg; 62.5g sachets, packed 148 per carton	595	Carton
	Syngenta	Packing, Shipping, Labelling CIP Kigali, Rwanda	1	Lot
B	H. D. Hudson	X-Pert Model 67362AD 3-Gal. Sprayer with Steel 8001 Tip	600	Ea
	H. D. Hudson	X-pert Model 148-676 Sprayer Repair Kit	12	Ea
	H. D. Hudson	Spare X-Pert Model 8001 Steel Nozzle Tip	100	Ea
	H. D. Hudson	Spare X-pert Model 152-356 Filter Nylon	600	Ea
	H. D. Hudson	Export Packing Charge	1	Lot
C	Conney Safety	PN 83750, General Purpose Coverall, Chicago Protective, Grey, Sm.	200	Ea
	Conney Safety	PN 83751, General Purpose Coverall, Chicago Protective, Grey, Med.	760	Ea
	Conney Safety	PN 83752, General Purpose Coverall, Chicago Protective, Grey, Large	120	Ea
	Conney Safety	PN 83753, General Purpose Coverall, Chicago Protective, Grey, XL	120	Ea
	Conney Safety	Bump Cap Assembly, incl. PN 59559 Hard Hat, PN H24M Suspension, PN 73412 Polycarbonate Face Shield	600	Ea
	Conney Safety	Blue/Green 13" 28-mil Latex/Nitrile Glove, Dozen, X-Large	42	Ea
	Conney Safety	Blue/Green 13" 28-mil Latex/Nitrile Glove, Dozen, Large	42	Ea
	Conney Safety	Blue/Green 13" 28-mil Latex/Nitrile Glove, Dozen, Medium	262	Ea
	Conney Safety	Blue/Green 13" 28-mil Latex/Nitrile Glove, Dozen, Small	71	Ea
	Conney Safety	PN 46141, Black PVC Boot with Steel Toe, Pair, Size 4	102	Ea
	Conney Safety	PN 46144, Black PVC Boot with Steel Toe, Pair, Size 7	378	Ea
	Conney Safety	PN 46147, Black PVC Boot with Steel Toe, Pair, Size 10	60	Ea
	Conney Safety	PN 46150, Black PVC Boot with Steel Toe, Pair, Size 13	60	Ea
D	Noble Ltd	PN ZC0054, Respirator Mask, 3M-9211, 10 per box, 12 box per case	167	Case
E	Caligor	PN 9004072: One-Step +hCG Urine Strip Dip Pregnancy Test, Box 25	14	Ea
	Caligor	PN 6926877: First Aid Kit 10 Person Waterproof	22	Ea

Lessons learned and recommendations for future IRS activities

By the end of the program, most people in Kigali City were aware of IRS and ICON WP. Densely populated areas allowed spraying of more houses, especially in urban parts of the city. There was also a remarkable delivery and supply of commodities (PPE and ICON) on time at most IRS sites. The program was supported by the general population, as manifested by the voluntary provision of drinking water to sprayers. The program was also supported by the local authorities when they willingly provided offices for IRS operations at the sector level. The program also became popular as it provided employment to local communities. Good communication and working relationships between local leaders and IRS personnel enhanced the success of the spray round. Another attribute to the success of this round is the IEC implementers who worked as an advance party, making people aware before the spraying of their houses the following day.

Recommendations

The following recommendations were made during various evaluation meetings

- IEC implementers and sprayers need further training in their respective activities, as the time allotted to their training was shorter and therefore they were starting the spray round without having acquired adequate knowledge. The IEC implementer training should also include a component on communication skills.
- There is also a need for feedback meetings at sector levels between health officers, village chiefs, and sector managers.
- If possible, more sprayers could be added to some sectors which had a small number of sprayers.
- Re-enforcement of discipline among some IRS operators was necessary; undisciplined sprayers should be replaced by stronger ones who can be trained to take over responsibilities. This should also apply to physically weak sprayers.
- All sectors should perform an internal evaluation at the sector level at least once a week.
- It was proposed that town hall meetings should be organized for more sensitization of the public on IRS.
- Mobilization of local leader for IRS operations was seen as indispensable for the program.
- Insurance for IRS operators should be introduced for forthcoming rounds.
- Evaluation meetings by IRS operators after every spraying day were seen as equally important.