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U.S. President's Malaria Initiative

Indoor Residual Spraying 2 (IRS 2) Kenya

Task Order 2 Final Report

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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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Table of Contents

List of Figures

List of Tables

Abbreviations

ACSM	Advocacy, Communication, and Social Mobilization
CHW	community health worker
COP	chief of party
DC	district coordinator
DEO	district environmental officer
DHMT	District Health Management Team
DMOH	district medical officer of health
DO	District Officer
DOMC	Division of Malaria Control
DPHO	district public health officer
EIA	Environmental Impact Assessment
GOK	Government of Kenya
GPS	global positioning system
GR	geographical reconnaissance
IEC	information, education, and communication
IRS	indoor residual spraying
IRS NSC	DOMC's National Steering Committee
ITN	insecticide-treated nets
KNMS	Kenya National Malaria Strategy
M&E	monitoring and evaluation
MOPHS	Ministry of Public Health and Sanitation
MPESA	mobile phone fund transfer service
NEMA	National Environmental Monitoring Agency
NHSSP	National Health Sector Strategic Plan
PMI	United States President's Malaria Initiative
PPE	personal protective equipment
RBM	Roll Back Malaria
SEA	supplemental environmental assessment
SOP	standard operating procedures
TOT	training of trainers
USAID	United States Agency for International Development
USG	United States Government
WHO	World Health Organization
WHOPES	WHO Pesticide Evaluation Scheme

1 Introduction

1.1 Global Burden of Malaria

Malaria remains one of the leading causes of death in Africa. The World Health Organization (WHO) estimates that approximately 655,000 people died from malaria in 2010 globally, of which 596,000 occurred in Africa.[1] Children under five years of age and pregnant women are the population groups at the greatest risk of contracting malaria. According to WHO, approximately 7% of all deaths among children U5 is caused by malaria.[2] Malaria morbidity is also a primary concern as sick children and adults miss school and work, which can impact livelihoods for months and years to come. On a macro level, malaria mortality and morbidity deters development of economic systems in many sub-Saharan countries through loss of household income in general, whether by sickness or death. Furthermore, high malaria rates place huge burdens on health care systems at all levels, as nurses and doctors spend a disproportionate amount of time attending to malaria patients, and scarce Ministry of Health (MOH) resources are poured into treating patients that repeatedly contract this preventable and controllable disease.

Though the burden of malaria remains high, there have been some promising gains in the past few years from malaria control efforts led by the Global Fund to Fight AIDS, Tuberculosis and Malaria, the United States Government's President's Malaria Initiative (PMI), other major funders, and host country governments. WHO reports that global malaria mortality rates have declined by 25% from 2000 to 2010 and by 33% within Africa.[3] Reductions are largely attributed to four key interventions: (1) indoor residual spraying (IRS) of households with insecticide, (2) insecticide-treated nets (ITNs), (3) increase in rapid diagnosis, and (4) effective treatment of cases with antimalarial drugs.

1.2 Malaria in Kenya

Malaria is one of the leading causes of morbidity and mortality in Kenya and is responsible for a loss of more than 40,000 lives annually, the majority being children. Out of the 41 million people who were at risk of contracting malaria in 2011 in Kenya, approximately 11 million were suspected to have the disease, with 9.1 million cases being actually confirmed.[4] The high burden of malaria strains the health care system in Kenya with up to one third of outpatient

[1] "Ten Facts on Malaria," WHO, last modified March 2013, accessed April 17, 2013, http://www.who.int/features/factfiles/malaria/en/index.html.
[2] "Children: Reducing Mortality" Factsheet No. 178, WHO, last modified September 2012, accessed April 17, 2013, http://www.who.int/mediacentre/factsheets/fs178/en/index.html.
[3] "Key Malaria Facts," Roll Back Malaria, last modified December 2012, accessed April 17, 2013, http://www.rbm.who.int/keyfacts.html.
[4] "World Malaria Report, 2012," WHO, last modified April 2012, http://www.who.int/malaria/publications/world_malaria_report_2012

attendance and 20% of admissions to health facilities being related to malaria.

The disease also contributes to lost economic productivity due to absenteeism and reduced performance at work and school. An estimated 170 million working days are lost in Kenya each year because of malaria illness.

1.2.1 Kenya National Malaria Strategy Strategic Approaches

To address the severe burden of malaria, the MOPHS in Kenya has prioritized malaria control through the National Health Sector Strategic Plan 2009–2014 (NHSSP II) and mandated the Division of Malaria Control (DOMC) to coordinate the implementation of the Kenya National Malaria Strategy 2009–2017 (KNMS) in collaboration with partners such as PMI, RTI, and other government agencies in Kenya.

The KNMS 2009–2017 was developed in line with the Government of Kenya's first Medium-Term Plan—developed as part of the Kenya Vision 2030, Millennium Development Goals—as well as Roll Back Malaria (RBM) partnership goals and targets for malaria control.

The KNMS 2009–2017 strategic approaches include the following:

- Case management
- Formulation and implementation of malaria treatment policy issues
- Management of malaria and anemia in pregnancy
- Malaria prevention measures and treatment of pregnant women
- Vector control
- Epidemic preparedness and response
- Advocacy, communication, and social mobilization capacities
- Monitoring and evaluation (M&E) and operational research to provide reliable information on progress in controlling malaria

The vector control strategies deployed in Kenya include, but are not limited to, IRS with insecticides, insecticide-treated nets (ITNs), larval control, and environmental management.

1.3 PMI Support for IRS in Kenya

In line with the KNMS and with funding from PMI, USAID awarded RTI International the Indoor Residual Spraying (IRS) 1, Task Order 2 bilateral contract in 2008. The task order provided funding for IRS activities in Kenya from 2008 to 2009. Under the two years covered by the task order, in collaboration with the DOMC, RTI managed the spraying of 881,992 structures in three districts; protected 2,693,213 people; and gained countless lessons learned that were shared through annual spray performance reports and evaluation meetings and used to build the capacity of key local stakeholders.

Following IRS 1, in early 2010, PMI awarded RTI the follow-on contract IRS 2 Task Order 2 (hereafter IRS 2 TO2) to provide funding for an additional three years of IRS in Kenya, reflecting a continued strong commitment from USAID to support the use of IRS as an effective malaria control intervention in Kenya. Through IRS 2 TO2, RTI provided technical, operational, and managerial support to DOMC under the MOPHS and other national and

district level stakeholders to build local and regional capacity and provide management and quality assurance for the implementation of IRS. The IRS 2 TO2 scope of work included the following four key objectives:

- Objective 1—Support IRS planning, operations, and logistics for implementation in Kenya
- Objective 2— Ensure that all aspects of contractor-funded IRS programs are implemented in an environmentally sound manner, in compliance with Kenyan and United States Government (USG) environmental regulations
- Objective 3—Strengthen the capacity of DOMC and public sector at all levels to plan, implement, and monitor operations with the goal of enhancing long-term sustainability of IRS programs in Kenya
- Objective 4— Conduct appropriate M&E to ensure quality control measures are established and implemented

The PMI IRS project in Kenya was implemented in three districts in 2010 and 2011 (Rachuonyo, Nyando, and Migori) and an additional district was added in 2012 (Homa Bay), as shown in the map in Figure 1. Since the start of IRS 2 TO2, RTI provided support to the DOMC to conduct three IRS rounds in Kenya. From 2010 through 2012, the IRS Kenya project sprayed 1,632,042 structures and protected 6,160,651 people, including 1,107,586 children under five years old and 119,604 pregnant women. Throughout the three years, the project trained 8,989 people to conduct IRS campaigns. Overall results are shown in Table 1. Detailed project results disaggregated by district are shown in Appendix A.

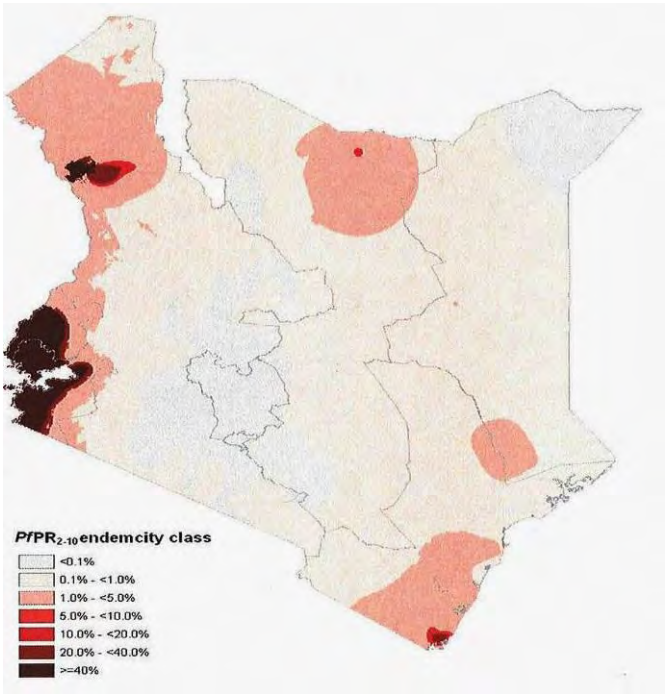
Table 1: IRS 2 TO2 Project Results

Year	Structures Sprayed	Structures Found	Average IRS Coverage	Population Protected	Children under 5 Years Old Protected	Pregnant Women Protected	People Trained In IRS*
Total	1,632,042	1,665,658	98%	6,160,651	1,107,586	119,604	8,989

*This category includes training of trainers' participants, spray operators, team leaders, and clinician training; it does not include IEC mobilizers, drivers, washpersons, or logistics/warehouse personnel.

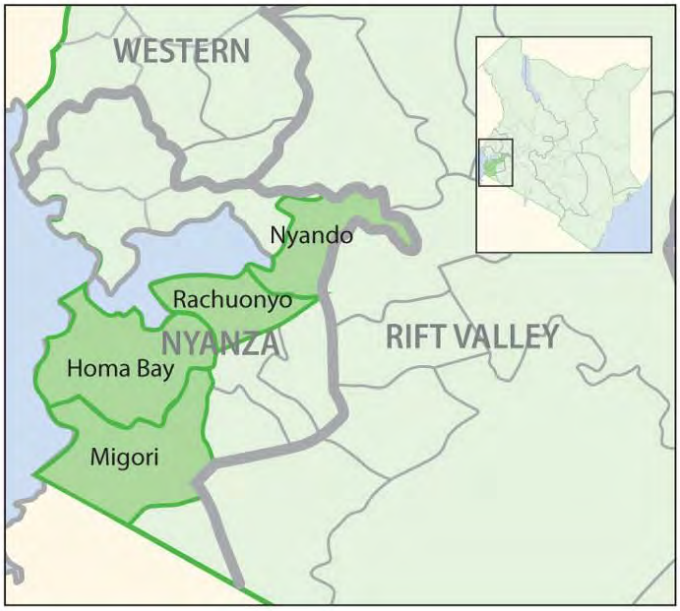
The DOMC and PMI collaborated to select IRS districts based on the malaria epidemiological profile and the transmission patterns of the district. As shown in Figure 1, the areas of high malaria transmission are mostly located on the western side of the country around Lake Victoria. Figure 2 shows the PMI-supported IRS districts in Kenya, illustrating their location within the areas of high malaria transmission in the southwestern corner of the country.

Figure 1: Map of the Various Malaria Epidemiological Zones, Based on Malaria Transmission Levels



Source: Division of Malaria Control, Kenya MOPHS

Figure 2: IRS Target Districts



Source: IRS Kenya Project 2012

1.4 Subcontractors

RTI collaborated with the following two key subcontractors as partners under IRS 2 TO2 to execute the SOW in a timely and efficient way:

- Crown Agents: managed commodity procurement, shipping, freight forwarding, and delivery
- Meridian Group International: managed public health information materials development, education and communications approaches, launch planning, and lessons learned documentation.

1.5 Overview of IRS 2 TO2 Achievements

During IRS 2 TO2, RTI achieved significant successes and met project objectives in each of the four areas specified in the task order. The following list provides an overview of other notable accomplishments under the IRS 2 TO2:

- Trained 8,989 spray personnel.
- Conducted timely and cost efficient procurement of 944,833 sachets of insecticide and spray equipment for three spray rounds.
- Implemented an IEC mobilization platform using community health workers (CHWs), which proved to be a more efficient use of existing resources and effective way to mobilize the community.

- Introduced the use of a cost-effective mobile phone-based money transfer service (MPESA) to pay seasonal workers
- Facilitated improved collaboration among DOMC, PMI, and partners in information sharing and evidence-based decision making on issues such as insecticide selection, entomological monitoring, and spray launch dates
- Trained 3774 IEC mobilizers/CHWs and IEC supervisors
- Facilitated the development of five training tools that were published as curriculum, guidelines and handbooks
- Implemented the use of global positioning system (GPS) devices for mapping IRS target areas
- RTI provided annual pre- and mid-spray environmental compliance inspections and promoted the transfer of responsibility in this area to local authorities by providing on the spot training
- Strengthened the M&E system for IRS 2 TO2 by implementing an improved relational database for capturing and analyzing data

1.6 Structure of this Report

This final report provides an overview of the achievements, innovations, lessons learned, and efforts toward promoting sustainability. Sections 2–5 address the four main task order objectives as outlined in the IRS 2 TO2 contract. Success stories and results are shared throughout the report under each component. ***Appendices A–F*** present comprehensive IRS data and the tools and materials developed for implementation of various IRS components. IRS tools and lessons learned can be used as reference for DOMC in Kenya and other.

2 Task Order Objective 1: Support IRS Planning, Operations, and Logistics for Implementation in Kenya

The IRS Kenya project worked in collaboration with DOMC and PMI through all phases of planning and implementation. Through sharing of tools, strategic staffing, collaborative planning, and implementation, three successful spray rounds were launched under IRS2 TO2 and the project realized the following achievements toward Objective 1:

- Worked collaboratively with DOMC and DHMTs to plan, implement, and monitor three successful spray rounds in Kenya
- Procured 944,833 sachets of pyrethroid insecticide as well as all other IRS commodities
- Secured warehouses in three districts in 2010 and 2011 and four districts in 2012 for safe keeping of IRS commodities
- Reduced program expenses by obtaining lower unit costs for commodities through bulk procurement and engagement of local suppliers
- Managed coordination of operations through hiring and training district coordinators that worked seamlessly with DOMC and DHMTs
- Facilitated district planning and operations meetings with stakeholders

- Effectively reached 1,094,487 households through IEC mobilization
- Developed innovative means to pay spray personnel in the field through mobile phone technology

2.1.1 Planning

Each year, planning for a spray round began six months before the scheduled launch date. RTI worked in collaboration with the DOMC National Steering Committee (IRS NSC) to facilitate the development of an IRS operational plan for the PMI-supported operational districts. District Health Management Teams (DHMTs) and district IRS steering committees also played a large role in planning and implementing the IRS Kenya project under IRS 2 TO2. The district IRS steering committees comprised the district medical officer of health (DMOH), district public health officer (DPHO), deputy DPHO, district malaria control coordinator, MOPHS's information, education, and communication (IEC) coordinator, representatives from the Ministry of Finance and Planning, National Environment Management Authority (NEMA), district environmental officers (DEOs), and other stakeholders.

The IRS NSC was instrumental in bringing together national stakeholders from a range of technical areas to discuss insecticide selection for IRS. With input from PMI and other entomology partners, the DOMC selected pyrethroid as the class of insecticide based on data from mosquito susceptibility studies, residual efficacy studies, and the duration of the transmission season in Kenya. Therefore, the IRS Kenya project sprayed with pyrethroid class insecticide for all three spray rounds under IRS 2 TO2.

As part of the planning process and as a capacity building activities for government of Kenya (GOK) counterparts, RTI worked with DOMC and IRS supervisors in the target districts to conduct geographical reconnaissance (GR) and to map areas targeted for IRS (see Section 5.2 for more information on mapping). This exercise was used to confirm the number, type, and structures to be targeted for spray activities and to develop the detailed operational plan for each district. After the GR activity, the IRS project supported the DOMC in organizing an IRS microplanning meeting with district leaders before spray operations commenced to generate consensus and discuss the roles and responsibilities of each partner in managing and monitoring IRS operations.

2.1.2 Logistics

The GR exercises and microplanning meetings provided valuable input about the number of warehouses, storerooms, soak pits, and vehicles needed for each round. In some districts, MOPHS facilities (e.g., offices, warehouses, and transportation) were available for IRS use, which reduced program costs and increased host country ownership and skill transfer.

Warehousing

The IRS Kenya project worked with the DOMC to identify and secure warehouses and storerooms for IRS commodities in each supported district. All commodities were stored in secure warehouse facilities and warehouse personnel were trained by the IRS logistics manager in stock management for IRS, using the *Best Management Practices for Indoor*

Residual Spraying in Vector Control Interventions (hereafter BMP Manual)[5] as a training tool. Commodities and equipment were tagged and controlled using a warehouse register and individual commodity stock cards. Warehouse staff reconciled inventory on all commodities daily during spray operations. At the end of the spray campaign, the commodities and equipment were reconciled, equipment properly cleaned, repaired if needed, calibrated, tagged, and appropriately stored.

The project established one primary warehouse in each IRS district and smaller storerooms were located at operational sites. The majority of the storerooms were provided by MOPHS. In a small number of locations where a physical structure was not available for a storeroom, the project utilized large containers outfitted for IRS compliance to store IRS commodities. This was found to be an economical and convenient solution to lack of storage space in the field. The number of warehouses and storerooms used each year is as follows:

- 2010: 3 district warehouses and 31 storerooms (28 provided by MOPHS)
- 2011: 3 district warehouses and 40 storerooms (all sub-stores provided by MOPHS)
- 2012: 4 district warehouses and 56 storerooms (all sub-stores provided by MOPHS)

IRS inventory being reconciled by a storekeeper

Transportation

The IRS project procured several vehicles used to transport spray operators from operational sites to villages during the spray round. The project conducted a competitive selection process to lease/rent vehicles; all leased vehicles complied with the specifications listed in the IRS BMP Manual. Moreover, project staff thoroughly trained drivers on safely transporting

[5] International Resources Group and RTI International. 2010. *Best Management Practices for Indoor Residual Spraying in Vector Control Interventions*. Prepared for PMI. Available at http://pmi.gov/technical/pest/bmp_manual_aug10.pdf

personnel and insecticide and handling emergency situations. The project used 176 vehicles in 2010, 179 in 2011, and 219 in 2012. Even though the project expanded to a fourth district in 2012, because CHWs took on the role of IEC mobilizers (see section 4.3.1), a reduced number of vehicles were needed for the spray round.

Teams wait to enter van after spray day

Procurement

The IRS Kenya logistics manager was responsible for all procurements under the task order. He worked closely with the home office supply chain specialist to ensure all procurements complied with USAID competitive procurement regulations. A number of improvements were made to the IRS Kenya procurement system under IRS 2 TO2, which resulted in additional cost savings.

The IRS Kenya project leveraged RTI's bulk procurement pricing on several IRS commodities that were purchased in bulk for the global IRS 2 TO1. Unit costs on key commodities such as spray pumps, overalls, and insecticide were much lower under IRS 2 due to negotiations by RTI based on economies of scale for IRS 2 TO1 and 2. To illustrate how unit costs dramatically decreased, we can look at the examples of overalls, gumboots, and insecticide. In 2008 under IRS 1, the project paid $27 for a pair of overalls procured internationally. Upon starting up IRS 2 TO2 in 2010, RTI negotiated this down to $20.41. Then, in 2011, through the use of local suppliers and bulk procurement agreements, the price dropped even further to $12 per pair of overalls. Similar dramatic reductions were seen in gumboots. Under IRS 1, the project paid $11.16 for a pair of gumboots, which dropped to $9.78 in 2010 and further down to $8.10 per pair in 2011. These savings were not limited to personal protective equipment (PPE). The cost of insecticide was also reduced greatly. In 2010, at the start of IRS 2 TO2, a pyrethroid sachet cost the project from $2.85 to $3 per sachet. With a 12-month contract in place, in 2011, RTI secured a price of $1.89 per pyrethroid sachet.

IRS spray pumps stored in IRS warehouse

Also, the increased use of local suppliers contributed to project savings. Through the experience gained under IRS 1, RTI was better informed on which suppliers carried high quality IRS commodities that could be sourced in Kenya. The benefits of the use of local suppliers were threefold. First, by working with regional vendors of IRS commodities, RTI supported capacity building within Kenya to provide quality commodities for IRS operations. Second, sourcing products regionally reduced costs of labor, shipping, clearance, and in some cases distribution. The unit cost of the regional items were often less expensive than the US-based vendors, especially when factoring in shipping (on average 60% lower using regional vendors). Third, by having long-term pricing agreements with local suppliers in place, RTI could accommodate unexpected commodity requests and meet critical deadlines.

2.2 Operations Coordination

The RTI IRS Kenya staff, in partnership with DOMC and DHMT officials, facilitated IRS operational program activities and ensured that IRS was conducted efficiently and in a cost-effective manner.

DOMC, PMI, and RTI jointly determined the timings of the IRS launch during the IRS NSC meetings based on timing of the malaria transmission season in the targeted districts. It was critical that the spray round be launched with enough time to spray all structures before the rainy season began in March. This ensured maximum protection since the malaria transmission period correlates highly with the increased mosquito population during the rainy season. The IRS project aimed to complete each spray round in 45 days or less in order to finish before the start of the rainy season. Building on the experiences and lessons learned from previous years, the project reduced spray time down to 40 days by the 2012 spray round.

District coordinators (DCs) were critical to the success of the IRS Kenya project. These were full-time IRS project staff who coordinated operations for each district. They worked in

collaboration with the DOMC, DHMT, supervisors, and team leaders to ensure that the project was on schedule and any challenges were addressed.

At the operational site level, operational site supervisors managed the day-to-day spray operations. This position was highly instrumental in synchronizing IEC and IRS operations, which was essential to making sure that the IRS campaign stayed on schedule and had high spray coverage. The operational site supervisor worked collaboratively with the IEC site coordinator to make sure that IEC mobilizers/CHWs sensitized the households before the spray operations began so that the households would be prepared. This position also provided oversight for team leaders, which helped keep them accountable for enforcing best practices in the field.

Half-way through each spray round, RTI participated in the district-level mid-spray review meetings that brought together national-level DOMC, RTI district and national IRS staff, DHMTs, district IRS steering committees, divisional supervisors, and team leaders for a meeting in each district. These forums enabled sharing of observations and challenges so that immediate solutions could be proposed and incorporated into implementation.

At the end of each spray round, district-level IRS evaluation meetings were held. This provided an opportunity for key stakeholders to come together and share achievements, challenges, lessons learned from the spray round. These sessions were closely documented for use in planning for the following spray round.

2.3 Supervision

Maintaining quality supervision for such a complex project as IRS is one of the top challenges. RTI built on lessons learned and our experience implementing previous rounds to improve the supervision framework in IRS 2 TO2. We planned and implemented an improved coordinated supervision protocol under this task order. For instance, roles of the district operations manager, M&E officer, logistics officer, and the district IEC coordinator were clarified so that each cadre understood its responsibilities and reporting lines. The DPHO's and team leader's supervisory roles and responsibilities were also revised and clarified during training.

Project staff reviewed and refined the supervisor's checklist from IRS 1 to facilitate monitoring of spray quality and identify challenging areas and personnel who needed additional training. The supervisor's checklist was regularly tracked, and supervision records were generated and reported to the district managers/IRS steering committees. Daily meetings of team leaders and other supervisors at operational sites took place daily and feedback from supervision forms were used to lead discussion on areas for improvement. More details on the supervision checklist can be found in Section 5 (Monitoring and Evaluation).

IRS supervisor preparing his team for the spray day

In addition, district IRS meetings were held every two weeks during the spray round to discuss IRS progress, gaps in supervision, and the way forward. RTI IRS technical staff conducted regular field visits to ensure that DCs, spray operators, supervisors, and mobilizers were complying with field requirements based on the supervision checklist and IRS SOPs.

2.4 IEC

IEC is one of the key components of the IRS project. IEC activities aim to inform beneficiary communities about the IRS project and the household's responsibilities in preparing for the IRS campaign. A strong IEC program is critical to promote acceptance of the IRS project and inform the community about the benefits and necessary precautions associated with this malaria control intervention. The Kenya IRS project worked in collaboration with the local, district, and national authorities in promoting IEC to encourage the community's acceptance of IRS as a national program (implemented under the DOMC) and create a sense of project ownership and responsibility. As a key activity for IEC, mobilizers conducted door-to-door sensitizations sharing key IRS messages with household members and distributing IEC brochures (in Dholuo) to each household. In total, over the course of IRS 2 TO2, 1,094,487 households were reached by IEC mobilizers (see table 2). The project relied heavily on the involvement of local and district leadership to minimize refusals for IRS by communities. The involvement of CHWs as IEC mobilizers greatly assisted with minimizing refusals (see Section 4.3.1 for more on this topic). Table 2 shows the number of households reached during the IRS Kenya project. Appendix B shows IEC coverage data broken down by district.

The specific objectives of the IRS IEC campaign were to

- Create long-term sustainability of the program by involving and engaging key community stakeholders;
- Inform beneficiaries about the benefits of IRS in controlling and preventing malaria and malaria-related deaths;
- Inform the beneficiaries of their role before, during, and after the spray operations;

- Inform key stakeholders and beneficiaries about environmental safety issues and health effects of using insecticides; and
- Address specific community beliefs and misconceptions about malaria and IRS in particular.

In collaboration with the DOMC's Advocacy, Communication, and Social Mobilization (ACSM) Technical Working Group and the DHMTs, the IRS project developed and used IRS IEC materials to share messages during door-to-door mobilization and civic group meetings.

Community meeting to discuss IEC messages for upcoming IRS spray round in Kenya

The IEC materials used in the Kenya IRS project included leaflets, T-shirts, songs, bags, banners, lesos (printed fabrics with IRS messages), caps, brochures, and IRS structure cards. In addition, community IEC activities included radio talk shows, interviews with opinion leaders, debates, radio spots, testimonials, public relations events, and project launch activities (See Appendix E for an IEC poster used in IRS Kenya). IEC activities were also planned for World Malaria Day each year. A parade was arranged in Nyanza and information about IRS was distributed to community members.

Table 2 – Number of Households Targeted and Reached by IEC Mobilizers

Year	Households Targeted	Households Reached
2010	305,099	314,605
2011	295,115	359,898
2012	451,986	419,984

Total		1,094,487

Spray personnel and IEC mobilizers parade in Nyanza for World Malaria Day 2012

2.5 Innovations

2.5.1 Use of Technology for Spray Personnel Payments

RTI partnered with a local Kenyan bank to pay spray operators using mobile phone technology to transfer funds, known as M-PESA in Kenya. In so doing, the IRS project successfully transferred funds directly from RTI's bank account to the corresponding IRS personnel's mobile phone M-PESA account. The M-PESA payment system was efficient, secure, and cost-effective for the IRS project. This system is now an established best practice.

2.6 Lessons Learned

Key lessons learned are summarized below.

- The use of community-based mobilization, (i.e., recruiting CHWs to conduct sensitization in the areas where they live and conduct their health activities) increased the community's acceptance of IRS
- Having an operational site supervisor(s) in charge of coordinating both IEC mobilization and spray operations increased harmony and streamlined coordination of the two activities
- Strong IRS steering committees at the district level under the leadership of the DMOH have been instrumental in reviewing performance routinely, avoiding role duplication, as well as rapid decision making during the campaign

- Where possible, district health authorities donated space for IRS warehousing at no cost to project. This also enhanced local ownership and partnership, in addition to cost savings to the project.
- Payment of seasonal staff salaries through M-PESA was a very efficient, cost-effective, and preferred payment system during IRS operations
- Early planning—IRS activities need to be initiated early and with sufficient lead time to ensure adequate preparation of districts. A six-month lead time was found to be the optimum period.
- Early agreements on insecticide class selection and targeted area by DOMC and PMI aided in timely commodity procurement for the IRS spray round.
- Consistent and regular communication with PMI, MOPHS/DOMC, and in-country stakeholders facilitates good working relationships and early problem solving.
- Coordinating a mid-spray evaluation meeting for each district improved communication and problem solving among all partners
- Involvement of the provincial administration in the IRS campaign enhances local ownership and sustainability. In particular, community leaders should be involved in sensitizing their respective communities about IRS and malaria control.
- Supervisors must ensure standard operating procedures (SOPs) are being followed regularly in the handling and use of all equipment to extend longevity and reduce restocking costs.
- The revised version of IEC brochure in Dholuo and English was widely accepted. Communities noted that the brochures were easier to understand since it had more illustrations and less text.
- Distributing promotional items (e.g., T-shirts, polo shirts, and lesos) strongly motivated the provincial administration, IRS implementing personnel, and community members who went out of their way to support and reach out to fellow community members encouraging them to support the campaign.
- Using local radio was an excellent outlet to disseminate information on malaria and IRS. However, more interactive radio messages should be developed to motivate and promote the community's preparation for the IRS campaign. Door-to-door mobilization and group mobilization was reported as effective in ensuring acceptability of the program.
- In the past, supervisors were selected before spray operator training began. From the experience of the IRS Kenya project, supervisors and team leaders should be selected during or after district training to allow for observation of leadership skills before selection for these important positions.

3 Task Order Objective 2: Ensure That All Aspects of PMI-funded IRS Projects Are Implemented in an Environmentally Sound Manner in Compliance with All Kenyan and United States Government (USG) Environmental Regulations

The RTI team worked closely with GOK partners (e.g., NEMA and DEO) to implement and monitor environmental compliance activities in Kenya. Environmental compliance activities were conducted by the RTI IRS Kenya team and RTI IRS environmental compliance officer to ensure full compliance with Kenyan environmental laws and regulations and with USG environmental regulation 22CFR216 throughout IRS 2 TO2.

Achievements toward Task Order Objectives include the following:

- Conducted, submitted, and received approval on the Supplemental Environmental Assessment (SEA) and related amendments
- RTI conducted three pre-spray, mid-spray, and post-spray environmental compliance inspections
- A total of three environmental audits were conducted by independent NEMA-accredited specialists during each round, with all of them receiving a satisfactory evaluation
- More than 24,025 kg of IRS contaminated waste were collected and safely disposed through high temperature incineration by a NEMA-certified agency in Nairobi
- Uncontaminated waste was safely disposed in each district under joint supervision of DEO and DPHO and a certificate of compliance duly issued.
- All insecticide samples that underwent quality assurance assay testing were found to be compliant with WHOPES standards

3.1 Supplemental Environmental Assessment

The SEA that was approved in 2008 was amended in February 2010 to allow for the expansion of the IRS project into two additional districts in Nyanza province (i.e., Migori and Nyando). RTI also amended the document to include three insecticide classes, which are all registered in Kenya and approved by WHO for IRS (pyrethroids, carbamates and organophosphates). In 2012, the RTI IRS environmental officer conducted an additional SEA in Homa Bay district for the 2012 spray round since the district was added to the IRS project.

3.2 Training in Environmental Compliance for IRS

IRS Kenya project helped to facilitate the USAID-supported Environmental Monitoring and Capacity Building in Vector Control Interventions project that conducted a regional environmental capacity building training program in Kisumu, Kenya (June 28–July 2, 2010). Several Kenyan partners participated in the training, which contributed to building national capacity in environmental compliance. As a result, these cadres were available to conduct independent environmental inspections for the IRS project.

Spray operators received full training each year on the use of PPE, progressive rinsing of spray pumps, insecticide handling, and safe IRS application techniques. Supervisors and team leaders were responsible for continuously observing their staff and providing oversight in the field.

3.3 Waste Disposal

Soak pits were established and used at each operational site to hold contaminated waste water from spray pumps at the end of the spray day. Proper maintenance and use of soak pits was carefully observed by site coordinators and district health staff during supervision visits.

Spray operators empty their spray pumps in progressive rinse barrels within the soak pit area

A NEMA-certified agency based in Nairobi handled disposal of IRS-contaminated waste (comprising insecticide packaging, insecticide sachets, disposable PPEs, and other insecticide-contaminated materials) from operational districts. Throughout the period of performance, more than 24,000 kg of contaminated waste were incinerated by the IRS project.

3.4 Quality Assurance of Insecticide

The active ingredient of each consignment of procured insecticides imported into Kenya for the project was tested to determine insecticide quality before field application. Upon arrival, the IRS logistics manager sent samples from new insecticide batches to the regional environmental officer for forwarding to an ISO-certified laboratory that tested and analyzed the amount of active ingredient to ensure all batches were in accordance with WHOPES specifications. All samples from imported procurements showed full compliance with WHOPES specifications.

3.5 Pre-/Mid-/Post-Spray Inspections

RTI IRS environmental compliance officers conducted environmental compliance inspections before, during, and after each IRS spray round in Kenya to ensure that best practices (from

PMI IRS BMP) and SOPs were being followed in the field. These checks ensured that stock was being stored properly and managed in warehouses; soak pits were constructed and used properly; insecticide was handled safely; and spray operators were wearing and using PPE correctly. After each inspection, IRS environmental officers wrote and shared a report with partners and IRS staff to highlight successes and areas for improvement.

3.6 Lessons Learned

Key experiences from which the IRS 2 project learned valuable lessons are listed below.

- Engaging government counterparts, particularly NEMA and DEO, early in the environmental compliance process promotes buy-in and ownership of the IRS program from planning to implementation and monitoring. Moreover, early involvement creates mutual trust and a collaborative relationship. As a result, joint supervision can be coordinated so that inspectors are available whenever needed during the course of the spray round.
- External monitoring for environmental compliance inspection should be encouraged and routine supervision must take place to boost compliance and maintain accountability at all levels of operation. A schedule should be agreed upon during the planning period.
- Consistent use of SOPs and the PMI IRS BMP Manual contributed to achieving success in environmental compliance. The tools provided the necessary guidance and reference on matters of environmental compliance from pre-spray preparations to closing down after a spray round. It is important to distribute field guides to all district offices and operational sites to serve as reference material.

4 Task Order Objective 3: Strengthen Capacity of DOMC and Public Sector at all Levels to Plan, Implement, and Monitor Operations toward the Goal of Long-term Sustainability of IRS Programs in Kenya

A key tenet of the PMI IRS 2 TO2 is building the capacity of the DOMC and other GOK authorities to plan, implement, and manage an IRS program. PMI through IRS 1 laid the foundation and built basic local capacity to conducting IRS since wide scale IRS had not been implemented in decades. IRS 1 focused on ensuring operations were carried out on time and according to best practice and emphasized evidence-based decision making by ensuring comprehensive M&E of activities. In IRS 2 TO2, RTI continued emphasizing the correct and safe application of IRS, but also aimed to expand the capacity of DOMC and other in-country authorities to gradually transfer responsibilities. PMI and RTI designed each component of IRS 2 TO2 (i.e., M&E, IEC, environmental compliance, and spray operations) to be centered on capacity building at the core.

An overview of achievements toward TO objectives in capacity building included

- Facilitating the development of five training tools

  - *Standard Curriculum on Indoor Residual Spraying for Malaria Control*
  - *IRS Trainers Guide*
  - *IRS for Malaria Control – A handbook for the IRS team*
  - *Guidelines for Indoor Residual Spraying for Malaria Control in Kenya*
  - *Post-Exposure First Aid Guide for Health Workers during IRS*
- Training a total of 1,096 MOHPS staff in managing supervising and implementing IRS
- Training a total of 477 IRS instructors through the training of trainers (TOT) program
- Training a total of 7,289 spray operators on safe and effective IRS application
- Training a total of 3,774 IEC mobilizers/CHWs on IRS community mobilization techniques

4.1 Learning by Doing

The principle strategy to build capacity at the district and national levels for IRS 2 TO2 was learning-by-doing or on-the-job training. RTI IRS staff worked seamlessly with district- and national-level counterparts throughout the planning and implementation periods to transfer knowledge and skills in management of IRS. The chief of party (COP) collaborated with DOMC leadership and other district and national authorities—such as NEMA, DEO, DHMTs—to develop and use tools (e.g., implementation plans, countdown calendars, etc.), provide technical guidance on insecticide selection criteria, timing of the spray round, and target area. This was done by coordinating partner planning meetings, technical steering meetings, and informal IRS strategy meetings. IRS 2 staff also encouraged joint field supervision trips to expose senior-level officials to implementation challenges in the field, effective problem solving, and the importance of supportive supervision.

4.2 Training of Trainers (TOT)

A cornerstone of RTI's IRS 2 TO2 operational management strategy was the subnational level TOT program. The district-focused training model aimed to develop a cadre of qualified facilitators that would be able to train a large pool of spray operators and mobilizers. Experienced IRS facilitators were drawn from those trained in previous IRS spray rounds as well as from the DOMC and DHMTs. In total, 477 IRS trainers were developed under IRS 2 TO2 through the TOT program. The number of women vs. men trainers was tracked from 2011 onward to encourage increased involvement of women in spray operations. In 2011, 67 out of 174 TOT participants were women; and in 2012, 60 out of 264 were women.

4.3 Training of Spray Operators, IEC mobilizers/CHWs, and Auxiliary Personnel

The IRS project worked in collaboration with the DOMC, DHMT, and community leaders to recruit spray personnel and auxiliary staff from local communities to reduce transportation costs and enhance ownership of the project by communities. Cadres included spray operators, supervisors, equipment technicians, drivers, washpersons, and IEC mobilizers/CHWs.

To keep training costs down and improve spray quality, priority was given to re-hiring spray personnel who had participated in previous spray rounds and had satisfactory reviews. Equal opportunity was given to both genders and selection was based strictly on pre-established spray operator criteria. All spray personnel were required to be numerate, literate, and physically fit. Female spray operator candidates were provided with pregnancy tests to make sure there were no pregnant women in IRS positions with direct exposure to insecticide. Those who were pregnant and had passed the physical fitness requirement were assigned positions that did not involve exposure to insecticide. In 2011 and 2012, there were 715, and

Selected cadres were provided full or refresher training and provided with standard operating procedures, job cards, and checklists to ensure quality IRS implementation. In total 7,289 spray personnel, including team leaders and supervisors, were trained, of those 1,946 were women. Table 3 provides a summary of the number of spray personnel and IEC mobilizers trained.

Spray operators learning how to use the progressive rinse system during practical training

4.3.1 CHWs as IEC Mobilizers

IEC mobilizers were also trained each year (see Table 3). In 2010, specially recruited IEC mobilizers were given training by RTI and DHMT in the key IEC messages for IRS and door-to-door mobilization and data collection.

IEC mobilizer visiting a house to share IRS IEC messages and deliver a brochure

In 2011, the IRS Kenya project piloted a new IEC mobilization strategy and rolled it out to all districts in 2012. Instead of recruiting and training IEC mobilizers, mobilizers were drawn from existing CHW networks to integrate IRS interventions and message delivery within the existing health system. This approach enabled the GOK and the IRS Kenya project to reduce overall costs, mobilize a large area in a short period of time, and strengthen capacity within the MOPHS. Moreover, the CHWs were familiar with and accepted in their communities, which allowed them to tailor their messages and mode of delivery to well-known audiences. CHWs are perceived by community members as trusted sources of information, who often go above and beyond their duties by conducting following up with community members several days after an intervention. During the pilot round, the IRS refusal rate dropped to 0.3%. After the success of the pilot, the IRS Kenya project expanded the strategy to all IRS districts in 2012. As an added benefit of using CHWs for IEC, the project saved on transportation since CHWs traveled by within the communities they lived in. Vehicles normally rented for IEC mobilizer transport were no longer necessary. See text box above and the success story in appendix H for more on CHWs as IEC mobilizers.

CHWs are perceived by community members as trusted sources of information, who often go above and beyond their duties by conducting following up with community members several days after an intervention. George Otieno, from Migori District, stated, "I was not sure if I would allow my house to be sprayed, but after [community] sensitization meetings, I agreed, and I have confirmed that malaria incidents in my household have gone down."

A community member speaks during an IEC meeting in the village

Table 3: Number of Spray Personnel and IEC Mobilizers Trained Each Year

Year	Spray Personnel*	IEC Mobilizers
2010	1881	381
2011	2088	919
2012	3320	2474
Total	7,289	3,774

*This category includes spray personnel, supervisors, team leaders, and TOT participants. It does not include auxiliary personnel such as washers, mechanics, or storekeepers.

4.4 Capacity Building: Development of Training Tools

4.4.1 Training Manuals and IRS Guidelines

RTI provided technical support to DOMC on the development of IRS guidelines, national IRS curricula, and other training materials that were specifically designed to produce trainers well equipped to facilitate and supervise knowledge transfer for effective IRS field operations. Two technical review meetings were conducted to appraise the draft documents, in addition to desk reviews. Participants in these workshops were drawn from the DOMC Epidemic Preparedness and Response Unit, Vector Control Team, and ACSM Team; the RTI technical team; WHO; Kenya Medical Research Institute/US Centers for Disease Control and Prevention; Division of Environmental Health; NEMA; and the University of Nairobi. The following five publications were finalized and produced by the IRS project in 2011 and used for the first time in 2012 to train personnel in IRS:

1. *Standard IRS Curriculum on Indoor Residual Spraying for Malaria Control*—For use in the TOT course and the spray operators training course
2. *Indoor Residual Spraying: Trainers Guide*—For use by training facilitators leading the spray operators training course
3. *Indoor Residual Spraying for Malaria Control: A Handbook for the IRS Team*—For use by all spray personnel as a field guide
4. *Guidelines for Indoor Residual Spraying for Malaria Control in Kenya*—For use by government and nongovernment implementers of IRS in planning and implementing high-quality IRS for malaria control
5. *Post-Exposure First Aid Guide for Health Workers During Indoor Residual Spraying*—For use by district health teams and clinicians in the IRS targeted areas.

4.5 National IRS Evaluation Meeting

After each spray round, the IRS project facilitated a national spray performance evaluation meeting to discuss results, challenges, and lessons learned. Participants included representatives from DOMC, MOPHS, DHMTs, district health offices, PMI, IRS Kenya staff, and other implementing partners. These meetings provided a forum for participants to voice their concerns, share challenges and solutions, and think critically on ways to improve IRS and areas for emphasis in the next round. Moreover, this exercise contributed immensely to capacity building of IRS leadership in the country.

4.6 Capacity-building Activities for the DOMC

RTI supported additional activities to strengthen the capacity of the DOMC and the DHMTs in managing and implementing IRS programs. These included the following:

- Providing technical assistance in planning for IRS and insecticide selection
- Assessing the DOMC's capacity at the national level
- Supporting working groups such as the Integrated Vector Management (IVM) Working Group and stakeholder forums that focus on institutional and capacity building in areas of malaria control
- Developing performance improvement and monitoring programs
- Supporting the DOMC to establish and manage a database of IRS master trainers and trainees to access this capacity for future IRS activities.

4.7 Lessons Learned in Capacity Building

Below, we summarize key lessons learned during implementation of the Kenya IRS 2 project.

- Data recording should be emphasized in both TOT and spray operator training. Errors in data recording have been identified as one of the main areas for improvement in M&E, and capacity needs to continue to be built in this area to ensure spray operators have a solid understanding of how to properly record spray coverage data in the field.
- Joint and simultaneous training of both IEC mobilizers and spray operators enhanced the understanding of each team's role and appreciation of the synergy required during spray operations.

- It is essential that the DOMC leads TOT to enable seamless transfer of leading these courses in the future.
- Engaging MOPHS, DOMC and DHMTs (District IRS Steering Committees) leadership in all stages of planning is instrumental in transferring skills and knowledge in IRS planning and management. This includes budgeting, human resource planning, and managing operations.
- Continuous and adequate supervision during training was found to be important in assessing facilitator effectiveness.
- Spray operators should be fully trained in the use and maintenance of the spray pumps to minimize damage and prolong the use of the spray equipment.
- Each district should have an appointed focal person from the DOMC or DHMT who is available throughout the spray round to work hand in hand with the IRS DC to ensure skill and knowledge transfer to Kenyan authorities. In so doing, local capacity increases and can be tapped to serve as DCs instead of hiring externally.

5 Task Order Objective 4: Monitoring and Evaluation

5.1 Achievements in M&E

Based on the experiences and lessons learned gained from IRS 1 TO1, RTI refined and improved the M&E component of the IRS Kenya project throughout IRS 2 TO2. For example, the M&E database was upgraded, systems were improved, and innovations were introduced to provide timelier, more accurate, and informative data to monitor and evaluate the project.

Achievements include

- Updated SOP for IRS indicators, which clarified the definition of "structure" and resolved ambiguity in calculation of IRS spray coverage
- The IRS Kenya project sprayed a total of 1,632,042 structures and protected 6,160,651 people from malaria
- Developed tools for data collection and monitoring of operations such as the IRS structure tool, the IEC data form, and the IRS spray card.
- Developed an improved, simplified relational database to capture all IRS data, developing reports, and disseminating project data
- Instituted the use of GPS devices for mapping found and sprayed structures and created several district maps for use in IRS and other district health programs.

5.1.1 IRS Operations Indicators

A set of IRS output indicators was discussed and agreed upon between RTI and PMI at the onset of IRS 2 TO2. To ensure a common understanding and clarify terms, definitions, and indicators, RTI developed an IRS SOP for M&E. The SOP was based on agreements reached

between PMI and RTI on how progress and outcomes of the IQC-level IRS 2 project should be measured and what defines the terms used in those indicators (see also PMI M&E Strategy: [http://pmi.gov/technical/mne/me_strategy.pdf] and PMI indicators [http://pmi.gov/resources/malaria/pmi_indicators.pdf]).

The following agreed upon core output indicators for PMI reporting were used in Kenya under IRS 2 TO2:

- Percentage of eligible structures in spray areas that were sprayed as a proportion of total found eligible structures (spray coverage)
- Number of eligible structures (houses) sprayed
- Number of people residing in structures sprayed (population protected)
  - Number of pregnant women residing in structures sprayed
  - Number of children under five years of age residing in structures sprayed
- Number of people trained to deliver IRS (disaggregated by gender and by type of training)
- Number of households found and mobilized by a trained IRS IEC mobilizer

During the work planning period, the IRS 2 TO2 COP worked closely with Kenya PMI advisors and DOMC leadership to agree on any additional indicators, beyond the PMI IRS core indicators that would be used to measure progress and success of IRS 2 TO2. In addition to the PMI IRS indicators, the DOMC requested that spray coverage be reported in terms of targeted structures. Accordingly, the IRS Kenya project ensured that spray coverage based both on targeted and found structures was reported. Tables 4 and 5 show the core indicator results for Kenya TO.

Table 4: IRS 2 TO2 IRS Operations Data

Year	Districts	Structures Sprayed	Structures Found	IRS Coverage	Population Protected	Children under 5 Protected	Pregnant Women Protected	People Trained In IRS*
2010	Rachuonyo Nyando, and Migori	503,707	518,359	97.17%	1,892,725	381,333	46,979	1,920
2011	Rachuonyo Nyando, and Migori	485,043	492,623	98.46%	1,832,090	265,776	21,456	2,252
2012	Rachuonyo Nyando, Migori, and Homa Bay	643,292	654,676	98.3%	2,435,836	460,477	51,169	4,817
Total		**1,632,042**	**1,665,658**	**97.98%**	**6,160,651**	**1,107,586**	**119,604**	**8,989**

Table 5: Total Number of Households* Found and Mobilized by an IEC Mobilizer

Year	Total Households Found	Households Mobilized	Percent Coverage
2010	321,615	314,605	98%
2011	361,797	359,898	99%
2012	451,986	419,984	93%
Overall	**1,135,398**	**1,094,487**	**96%**

*Note that households were counted instead of structures for this indicator.

In addition to these core indicators, the IRS Kenya project tracked and reported on the number of insecticide treated nets (ITN) found in IRS targeted structures (Table 6). The tracking of the ITN indicator was agreed upon by PMI and DOMC given the door-to-door nature of IRS and the benefit of collecting this data for use in IVM.

Table 6: Total Number of ITNs Found and Used by Pregnant Women and Children under Five Years Old in IRS Targeted Households

Year	Total ITNs Found in IRS Target Households	Pregnant Women Protected by IRS	Pregnant Women Sleeping under ITNs	Percent Pregnant Women Sleeping under ITNs	Children <5 Years Old Protected by IRS	Children <5 Years Old Sleeping under ITN	Percent Children < 5 yrs Sleeping under ITNs
2010	606,695	46,979	42,455	90.4	381,333	294,866	77.3%
2011	846,731	40,070	38,086	95%	388,492	343,612	89%
2012	1,001,587	51,169	48,899	95%	460,447	414,467	90%

*This category includes training of trainers' participants, spray operators, team leaders, and clinician training; it does not include IEC mobilizers, drivers, washpersons, or logistics/warehouse personnel.

5.1.2 M&E Tools for IRS Operations

RTI had developed M&E data collection tools for the IRS Kenya project under IRS 1. As a best practice, project staff and stakeholders reviewed all tools during each annual national level stakeholders' planning meeting to ensure that the data being recorded was sufficient and responsive for the needs of IRS 2 TO2 and the PMI and DOMC IRS indicators.

The following list provides a summary of the M&E tools used in the IRS Kenya project and a description of its purpose:

IRS spray card. Spray operators used this form daily to collect demographic data for each structure they visited and record whether the structure had been sprayed or not. The IRS spray card served as the primary IRS data collection tool. See ***Appendix D*** for an example of

a daily spray card from the Kenya IRS project. In 2011, the IRS spray card was revised to capture data recorded from the newly introduced IRS structure card (see Figure 3).

IRS IEC mobilization form. This form was used by IEC mobilizers (CHWs) to record demographic data from the household and whether the house had been fully sensitized for IRS.

IRS structure card. The structure card was introduced to the Kenya IRS project in 2011. During mobilization, the IEC mobilizer distributed a structure card for each structure in a household. Each card contained a unique identification number, which was recorded and used to track the structure and its accompanying data in the database. The inside of the card provided spaces for spray operators signatures for up to four years in order to track the household's acceptance of IRS for the following years given the program continued in the area.

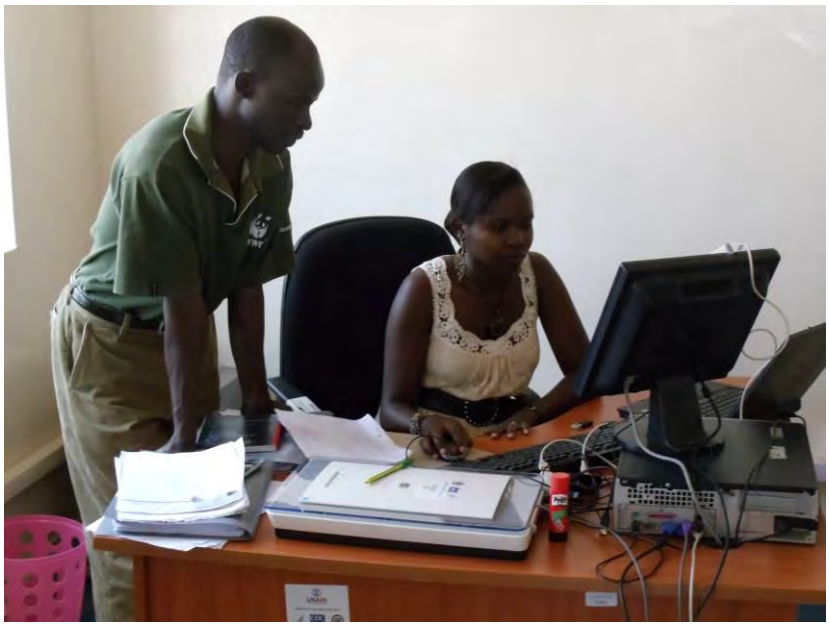
IRS supervision form. The supervisor's checklist was another M&E tool that was reviewed and revised annually. Supervisor forms were originally introduced to operations by RTI through IRS 1 as a best practice for M&E for field operations. In IRS 2 TO2, IRS Kenya continued to use the form to assess spray operation teams and individual performance. The IRS supervisor's checklist served as an important feedback mechanism to track performance of both supervisors and spray operators against previously noted areas for improvement. Supervisors provided feedback to the spray teams at the start of each day to highlight areas for improvement so that spray operators could be cognizant while during their workday. The supervisor's checklist also provided information on the performance of individual spray operators, which could be used to evaluate them for roles in future spray rounds. Furthermore, DCs could measure performance of supervisors by checking whether they were using the checklists as instructed.

IRS environmental compliance checklist. This checklist was used by trained environmental compliance inspectors to assess the level of readiness and compliance of IRS operations with Kenyan environmental compliance regulations, WHO standards, and PMI's IRS BMP Manual.

Spray operator recording M&E data in Kenya.

5.1.3 M&E System Development

During IRS 2, TO2, the IRS Kenya project switched from using a java web-based database to record IRS data to a revised simpler relational database that did not rely on the internet to function. This aligned with RTI's emphasis on strong management of information and aimed to minimize the opportunities for error and infuse efficiency in the process of data entry and report generation. The database was used to collect, analyze, and report on IRS data from the field to USAID/PMI and local partners, including DOMC.



IRS data is reviewed at a district office in Kenya

5.1.4 Use of Global Positioning System (GPS) for IRS M&E

To provide reliable and accurate data on location and number of targeted and sprayed structures, PMI supported the use of GPS devices to map the IRS targeted areas in Kenya in 2010 and 2011. As such, RTI procured 149 GPS devices and trained 15 supervisors and 140 mappers (65 in Migori, 40 in Nyando, and 35 in Rachuonyo).

The objectives of the mapping of IRS targeted households were as follows (see Figure 3):

- Determine the accurate number of households and housing units (to be sprayed) in the project districts as the accurate baseline
- Generate an accurate estimate of the baseline population in the target districts
- Create maps showing population density, distribution of housing units, and the population around a health facility

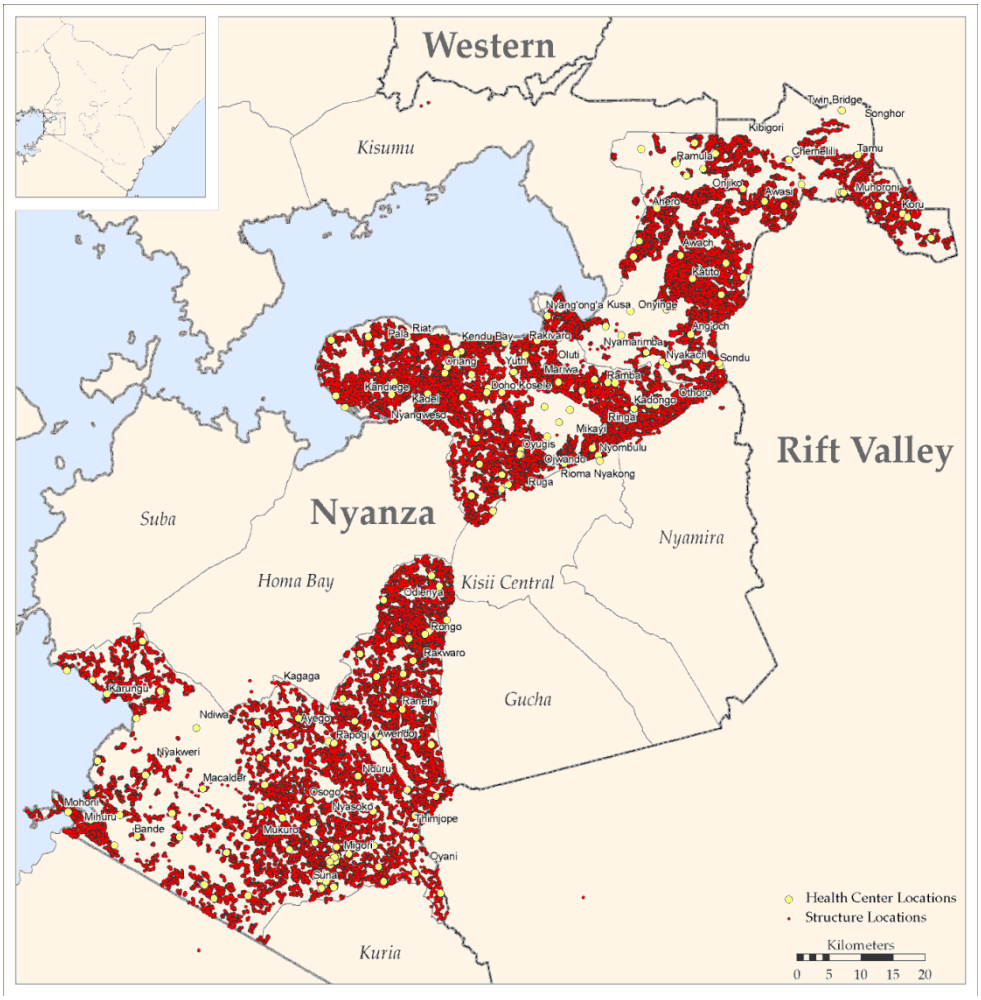
Figure 3: Process in Mapping Exercise for IRS Kenya

Training	Methodology	Supervision
In total, 15 supervisors and 140 mappers were trained for this exercise. Three consultants facilitated the workshop, two from RTI US and South Africa and one GIS technician from Survey of Kenya. The training comprised both theory and practical sessions covering topics on the role of the mapper in IRS operations, how to operate and manage the GPS receiver including how to configure and collect IRS data as well as capture and record eligible structure locations and attributes as waypoints. Supervisors included DOMC, IRS district coordinators, and RTI IRS Nairobi regional staff.	The approach involved recording household coordinates, total number of eligible housing units, population data (e.g., pregnant women and children under 5 years old), and use of ITNs. The mappers visited all households and collected a geo-point at the compound as they collected all other demographic data. Mapping personnel were expected to map 70 households per day. The 2011 mapping exercise took 33 days to complete with 140 mapping personnel.	MOPHS personnel at both the district and division levels supervised and coordinated the mapping exercises, ensuring that all GPS devices were issued to the mappers every day, collected at the end of the day, and submitted to the data clerks to download the geo-points. RTI personnel at the district and national offices provided technical support supervision during the exercise and ensured that all required logistics were available to facilitate the exercise.

5.2 Mapping Results

During the mapping exercises in 2010, not all structures were mapped as planned due to logistical challenges. Out of the 518,359 structures found, only 223,931 (43%) structures were mapped. For this reason, the exercise was repeated with greater success in 2011. Figure 4 shows the distribution of structures mapped in the 2010 mapping exercise.

Figure 4: Distribution of Mapped Structures in IRS Districts 2010



Source: IRS Kenya Project, 2011

In 2011, the mapping activities were greatly improved and more structures were found and mapped. In total, 384,966 IRS-eligible structures were found and mapped in Migori, Nyando, and Rachuonyo during the mapping activity. Table 7 and Figures 5–7 provide details on structures found and mapped in each district.

Table 7: District Mapping Data 2011

District	Total Population	Number of Children under 5	Number of Pregnant Women	Total ITNs	Number of Eligible Structures Found
Migori	546,364	129,489	11,265	94,278	180,264
Nyando	301,190	63,906	4,824	71,511	100,120
Rachuonyo	333,272	72,381	5,367	56,550	104,582

Figure 5: Structures Found in Migori 2011

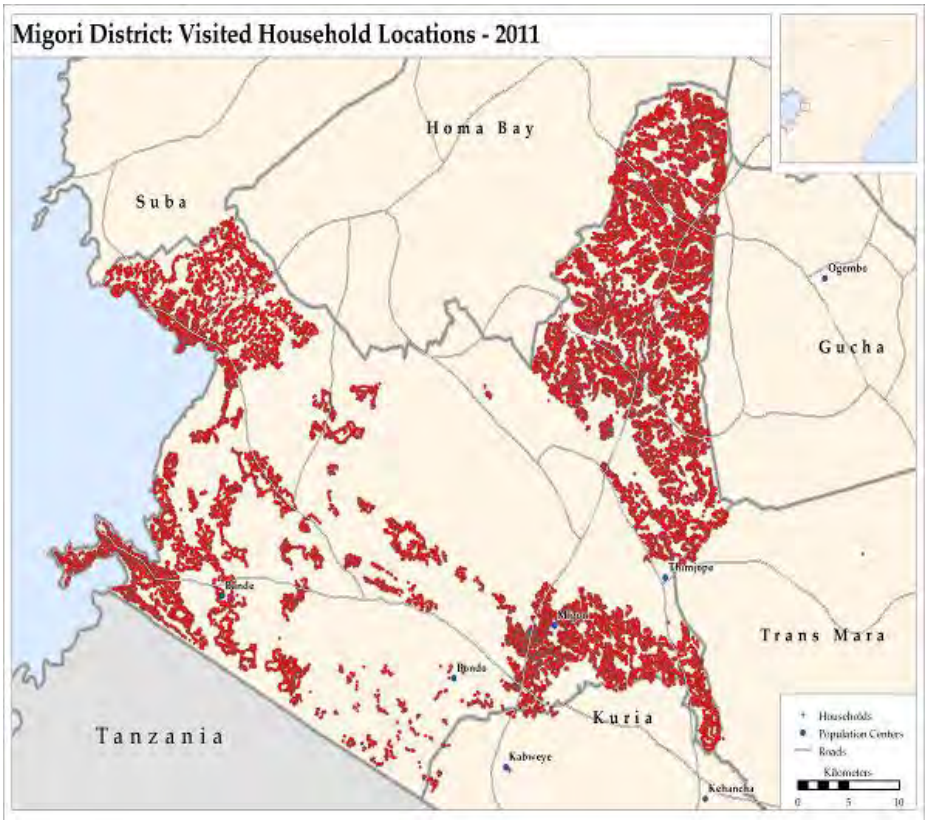


Figure 6: Structures Found in Nyando 2011

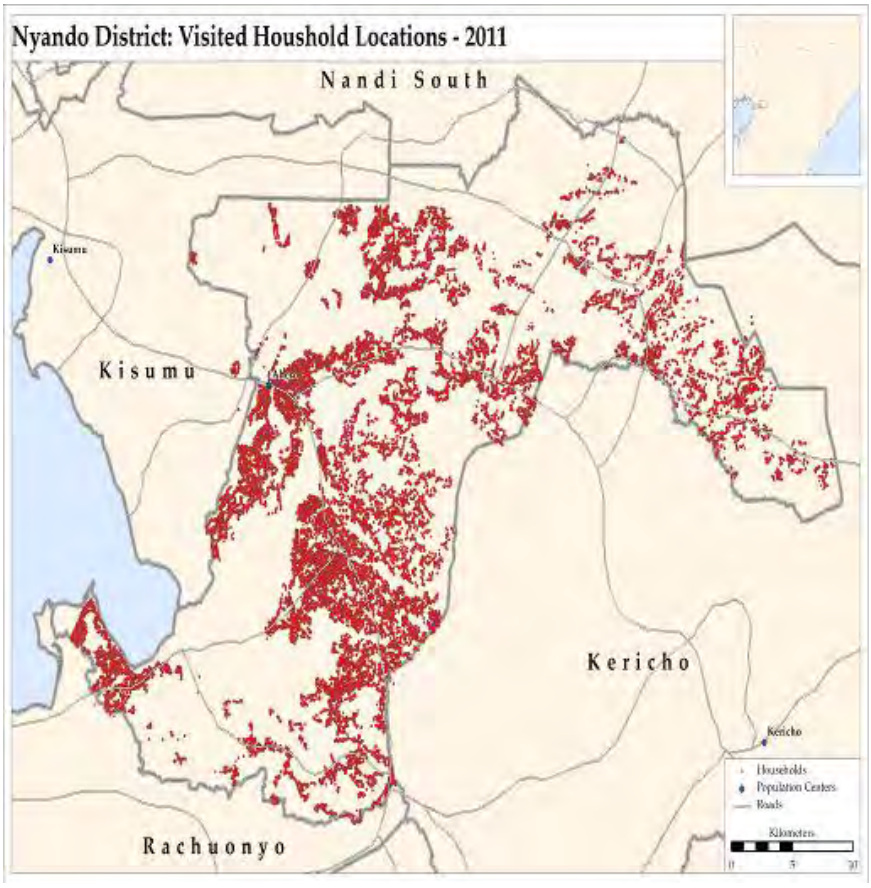
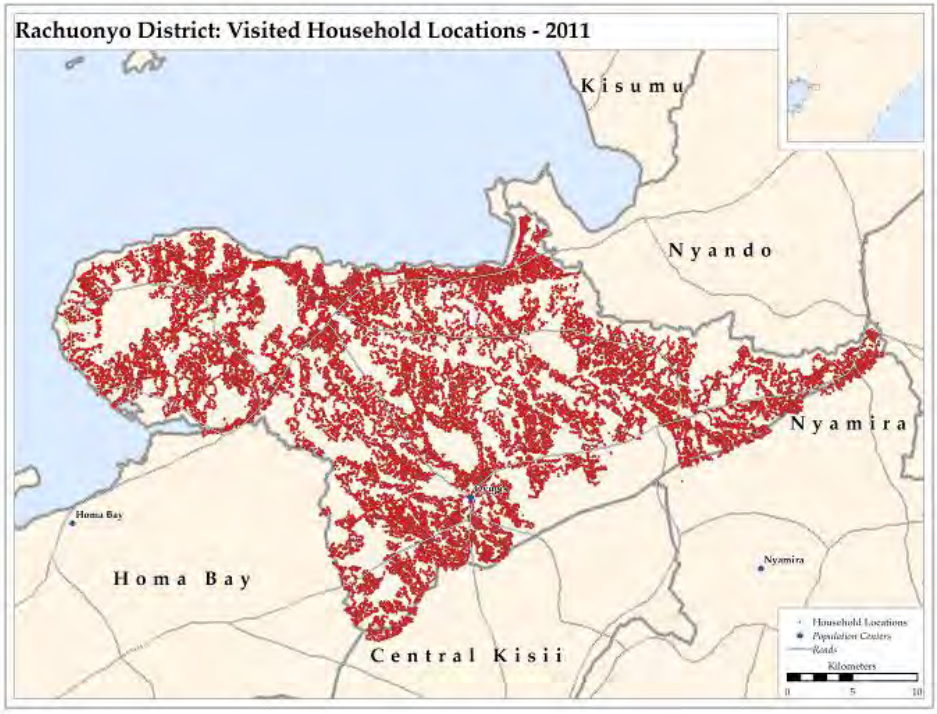


Figure 7: Structures Found in Rachuonyo in 2011



5.3 Lessons Learned in M&E

- Data Recording Errors. Errors found on spray cards by data clerks had to be returned to the field for corrections, which led to delays in data entry. Supervision and spot checks on data recording in the field is very important to ensure timely and accurate data entry and reporting.
- Data entry points should be located at each district so that data are entered in a timely manner and data clerks have access to field teams in order to ensure corrections are quickly addressed.
- It was helpful to link data from IRS operator forms with data from IRS storerooms across all reporting levels to verify accuracy of coverage and insecticide usage data.
- Spray operations quality is highly dependent on supervision in the field. It is important for supervisors to use the IRS supervision form to evaluate individuals in the field and use feedback for sharing with field teams before each spray day.
- There were several occurrences when spray operators purposefully entered false data to appear to have sprayed more houses. DCs, DOMC leadership, and supervisors must be clear about the repercussions for intentionally recording false data (suspension or dismissal).
- Competing health activities in the districts affected the availability of both DOMC and DHMT staff and led to inadequate supervision from the district teams and divisional supervisors. Discussions during the pre-spray planning period must address

commitment by DOMC and DHMT and timing of IRS with other health activities in the district.

- Fragmenting of administrative boundaries, due to the incomplete boundary delimitation exercise by the GOK complicated data entry and analysis due to the numerous divisions, locations, and sub-locations found in every district.
- Frequent power outages at district offices complicated data entry and resulted in a delay in the relay of district reports, which in turn led to delayed weekly reporting on spray progress. District offices should have back-up generators to ensure data reporting is not affected by power outages.

Appendix A: IRS Operations Data 2010–2012

Table A-1: 2010 IRS Operations Data by District

District	No. of Structures Targeted for Spraying	No. of Structures Found during Spraying	No. of Structures Sprayed	Percent Spray Coverage	Total Population Protected	No. of Pregnant Women Protected	No. of Children <5 Yrs. Protected
Migori	283,828	241,297	231,994	96%	866,515	25,502	184,456
Nyando	183,122	140,512	136,997	97%	489,487	9,923	97,105
Rachuonyo	157,970	136,550	134,716	99%	536,723	11,554	99,772
Totals	**624,920**	**518,359**	**503,707**	**97%**	**1,892,725**	**46,979**	**381,333**

Table A-2: 2011 IRS Operations Data by District

District	No. of Structures Targeted for Spraying	No. of Structures Found during Spraying	No. of Structures Sprayed	Percent Spray Coverage	Total Population Protected	No. of Pregnant Women Protected	No. of Children <5 Yrs. Protected
Migori	247,166	234,328	230,977	99%	891,084	24,956	205,671
Nyando	153,053	130,987	128,819	98%	475,719	7,180	88,683
Rachuonyo	147,747	127,308	125,247	98%	465,287	7,934	85,716
Totals	**547,966**	**492,623**	**485,043**	**98%**	**1,832,090**	**40,070**	**380,070**

Spray Operations Data 2012

Table A-3: Summary of Kenya 2012 IRS Results

District	No. of Targeted Structures	No. of Found Structures	No. of Sprayed Structures	Percent Spray Coverage	Total Population Protected	No. of Pregnant Women Protected	No. of Children <5 Yrs. Protected
Rachuonyo	138785	134,166	133,685	99.6%	497,665	9,104	87,711
Nyando	137587	122,265	119,875	98%	440,687	6,684	77,580
Migori	199,260	192,394	189,634	98.6%	757,667	20,996	155,140
Homa Bay	217,428	205,851	200,098	97.2%	739817	14,405	140,016
Total	**693,060**	**654,676**	**643,292**	**98.3%**	**2,435,836**	**51,189**	**460,447**

Appendix B: IEC Mobilization Coverage

Table B-1: IEC Mobilization Coverage by District 2010

District	Targeted Households	Households Mobilized
Migori	135,156	144,188
Nyando	91,423	85,120
Rachuonyo	78,520	85,297
Overall	305,099	314,605

Table B-2: IEC Mobilization Coverage by District 2011*

District	Target Households	Households Mobilized
Rachuonyo	79200	76902
Nyando	80759	109433
Migori	135156	173563
Total	**295115**	**359898***

*In 2011, more households were found than expected when IEC targets were set.

Table B-3: IEC Mobilization Coverage by District 2012

District	Target Households	Households Mobilized
Rachuonyo	83,606	81,026
Nyando	90,885	96,019
Migori	146,514	136,518
Homa Bay	130,981	106,421
Total	**451,986**	**419,984**

Appendix C: Year 2 Implementation Plan and Timeline (2011)

Year 2 Work Plan (2011)

Tasks by Objective	Indicator	Outputs	Timeline (January–December 2011]											
			J	F	M	A	M	J	J	A	S	O	N	D
Objective 1: Manage IRS Operations														
1.1 Conduct appropriate planning for IRS in collaboration with DOMC/MPHS	Baseline information on targeted households established	Geographical reconnaissance and log. Needs assessment complete in all 3 districts	X	X										
1.2 Use modern technologies and tools to produce up-to-date district and division maps	GIS database completed and transferred to DOMC	Mapping completed (original + 1 set); 140 trained mappers/data collectors	X	X										
1.3 Work with DOMC, PMI and others to select insecticide, equipment and accessories	Appropriate insecticide and PPE selected	Appropriate insecticide selected on time	X											
1.4 Work in collaboration with provincial and district health officials in IRS implementation	Percent of structures sprayed against target structures	85% structures sprayed; 750,000 structures targeted	X	X	X	X	X	X	X					
1.5 Procure sufficient insecticide, sprayers, and PPE to complete IRS campaign in designated districts	Transparent competitive bid process completed	Sufficient amount of insecticide procured and delivered in districts	X	X										
1.6 Prepare and execute logistical plans for managing IRS-related commodities, including port clearance, warehousing and handling, inventory, etc.	Commodity transport plans in place for transport from Nairobi to ops bases; post-spray inventory completed	100% of operational bases complete inventory; *3* districts have commodity transport plan in place	X	X	X	X	X	X	X					
1.7 Plan and implement with the DOMC appropriate and necessary training activities for the range of skills needed to safely and effectively implement IRS	No. of spray operators, mobilizers, drivers, and storekeepers trained on IRS; national training curriculum for IRS developed together with DOMC	4,700 IRS staff trained; sufficient # training guides published	X	X										
1.8 Provide IRS-specific IEC/BCC before, during, and after any campaign	No. of brochures and posters produced and disseminated; percent of people reporting to have heard IRS-related radio message; % HH found and mobilized for IRS	453,300 brochures and posters produced; 85% HH heard radio messages; 100% of HH mobilized; 500,000 household cards		X	X	X	X	X	X					
1.9 Conduct qualitative research on perceptions, misconceptions, and attitudes toward IRS	No. of focus group discussions (FGD) held pre- and post-IRS	15 FGD, one in each division	X	X				X	X					

Tasks by Objective	Indicator	Outputs	Timeline (January–December 2011]											
			J	F	M	A	M	J	J	A	S	O	N	D
1.11 Provide all aspects of operation and management support to ensure successful implementation of IRS	No. of daily supervisory support visits from RTI and government health personnel	20,000 visits (50 days × 40 supervisors × 10 visits/day		X	X	X	X	X						
1.12 Conduct pre-spray workshop and post-spray review for DOMC	3-day pre- and post-spray workshop in 17 target districts	250 pre-spray and 400 post-spray participants		X		X		X	X					
1.13 Provide logistical support to DOMC for IRS in epidemic districts	Areas of support identified and operations plan development	2 meetings with DOMC as need arises; operational plan finalized	X	X	X	X	X	X	X	X	X	X	X	
Objective 2: Ensure Environmental Compliance														
2.1 Conduct IEE/SEA and amendments to existing documents as needed	SEA completed	SEA for 1 new district completed on time		X										
2.2 Adhere to PERSUAP and its amendments	Environmental compliance pre-, during, & post-spray	Reports and certificates of compliance		X	X	X	X	X	X	X	X	X	X	
2.3 Ensure the quality and safety of the insecticide purchased, including logistics for safe distribution, storage, handling	No. of people trained on environmental compliance and safe handling/storage of insecticide	5,300	X	X	X	X	X	X	X	X	X			
2.4 Implement procedures for disposal of insecticides, waste products, and package material	Proper storage and incineration of waste	Incineration certificates						X						
2.5 Ensure that procurement and logistics systems include adequate safeguards to prevent pilferage or misuse of insecticides	No. of unannounced undercover visits to local markets; % of sachets properly reconciling	270 visits (1/week × 14 divisions); 100% sachets reconciled			X	X	X	X	X	X	X			
2.6 Ensure compliance with all national regulations and provide the documentation to USAID, NEMA, and MOPHS	No. of spray teams, personnel, and No. of operations' centers assessed during pre- & post-spray inspections	15 operational bases inspected; 30% of spray teams observed	X	X	X	X	X	X	X	X	X			
Objective 3: Strengthen DOMC Planning, Management and Implementation														
3.1 Support DOMC in planning strategy development for IRS programs in Kenya	Put in place and disseminate national IRS guidelines	Timeline and draft document disseminated	X	X	X	X	X	X	X	X				
3.2 Work closely with DOMC to support and facilitate the National IRS Steering Committee	IRS steering committee in place and functioning	Members selected; committee mandate in place	X	X	X	X	X	X	X	X	X	X	X	
3.3 Increase technical skills and capability among DOMC staff at all levels in IRS implementation and M&E	No. of DOMC/MOPHS staff trained and participating in data collection, entry, and analysis	54	X	X	X	X	X	X	X	X	X	X	X	X

Tasks by Objective	Indicator	Outputs	Timeline (January–December 2011]											
			J	F	M	A	M	J	J	A	S	O	N	D
3.4 Develop performance monitoring system for people trained	Performance monitoring system in place and functioning	System in place and piloted in one district		X	X	X	X	X	X	X	X			
Objective 4: Provide IRS Program Monitoring and Evaluation														
4.1 Provide ongoing monitoring and supervision of tasks	Monthly monitoring reports	12 reports	X	X	X	X	X	X	X	X	X	X	X	X
4.2 Implement a quality assurance/quality control system to monitor the quality of the spray campaigns	Robust system of IRS QA/QC in place	1 operational QA/QC in 3 districts		X	X	X	X	X	X	X	X	X	X	X
4.3 Adapt or develop a database/system available to DOMC and USAID to monitor HH/ house units sprayed	System adapted and functioning in all 3 districts	Database system producing reports regularly		X	X	X	X	X	X	X	X	X	X	X
4.4 Provide baseline information on targeted HH/persons by district	Data collected on households by DHMTs	1 baseline report on targeted HH by division	X	X										
4.5 Provide report summarizing indicators by district and division at the end of the spray season	Spray Performance report submitted to USAID	Summarized indicator reports by division/district							X					
4.6 Conduct end-of-spray (EOS) round meetings with stakeholders	EOS stakeholder meetings	3, one in each district and one nationally							X	X				
4.7 Support DOMC to establish data collection system in health facilities on key malaria indices	Percent of health facilities reporting malaria case data each month	Functional malaria surveillance sites operational		X	X	X	X	X	X	X	X	X	X	X

Appendix D: IRS Kenya Daily Spray Card for Primary Data Collection by Spray Operators

RTI IRS Form 1

INDOOR RESIDUAL SPRAYING PROGRAMME
DAILY SPRAY CARD

DISTRICT _____ DIVISION_____ LOCATION_____SUB-LOCATION _____

SPRAY OPERATOR'S ID _____ TEAM NUMBER [_____] DATE_____

SACHETS RECEIVED_____ FULL SACHETS RETURNED_____ EMPTY SACHETS RETURNED_____

HH Name	Structure ID (from IRS Structure card)	Eligible Structure									Eligible Rooms		Mosquito nets		
		Sprayed				Unsprayed									
		Sprayed	Total Pop	Children < 5 yrs	Preg women	# Not sprayed	Total Pop	Children < 5 yrs	Preg women	Reason	Found	Sprayed	Total	# of Pregnant women sleeping in	# of < 5 sleeping in
Total										*					

Reason for Not sprayed: *1 = Sick 2= Locked 3=Funeral 4=Denied 6=Missed 7=Other*

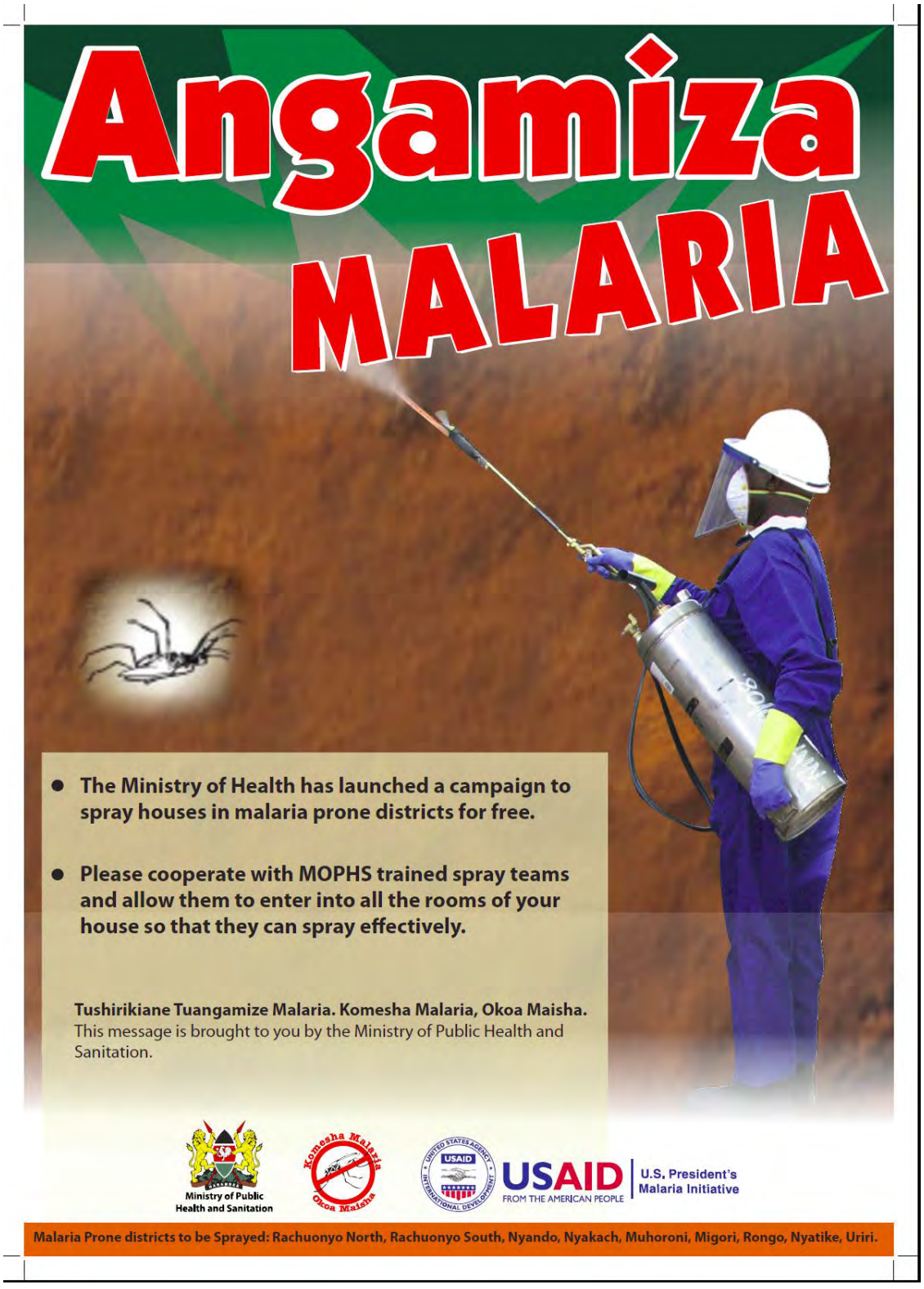
**** = Most common Reason***

Team Leader comment: _____ data verified: Yes ☐ No ☐ Date of verification __**_____** Signature_____

☐ TICK IF MOP UP

- Where mop up takes place, new records should be created in the database and old record edited by (sub-location) deleting that record from unsprayed, adding it to eligible structures sprayed and deleting the reason for being unsprayed.

Appendix E: IRS Kenya Poster from 2011 IEC



Appendix F: Reported Use of ITNs in Sprayed Households

Table F-1: 2010 Reported usage of Insecticide-treated nets (ITNs) found in sprayed households and the number and percentage of children under five and pregnant women using ITNs

District	Total ITNs Found in IRS Households	Children <5 Yrs. Protected by IRS	Children <5 years Sleeping under ITN	Pregnant Women Protected by IRS	Pregnant Women Sleeping under ITNs
Migori		184,456	134,660 (73%)	25,502	22,767(89%)
Nyando		97,105	82,384 (85%)	9,923	9,596 (97%)
Rachuonyo		99,772	77,822 (78%)	11,554	10,092 (87%)
Overall	606,695	381,333	294,866 (77%)	46,979	42,455 (90%)

Table F-2: 2011 Reported usage of Insecticide-treated nets (ITNs) found in sprayed households and the number and percentage of children under five and pregnant women using ITNs

District	Total ITNs Found in IRS Targeted Households	Children <5 Yrs. Protected by IRS	Children < 5 Sleeping Under ITNs	Pregnant Women Protected by IRS	Pregnant Women Sleeping Under ITNs
Rachuonyo		85,716	79,860 (93%)	7934	7519 (95%)
Nyando		97,105	81,503(84%)	7180	7078 (99%)
Migori		205,671	182,249 (89%)	24956	23489 (94%)
Total	**846,731**	**388,492**	**343,612 (88%)**	**40,070**	**38,086 (95%)**

Table F-3: 2012 Reported usage of Insecticide-treated nets (ITNs) found in sprayed households and the number and percentage of children under five and pregnant women using ITNs

District	Total ITNs Found in IRS targeted Households	Children <5 Yrs. Protected by IRS	Children <5 Sleeping Under ITNs	Total Pregnant Women	Pregnant Women Sleeping Under ITNs
Rachuonyo	205,643	87,711	81,421 (92.8%)	9,104	8,905 (97.8%)
Nyando	188,635	77,580	71,693 (92.4%)	6,664	6,505 (97.6%)
Migori	295,201	155,140	142,190 (91.7%)	20,996	20,056 (95.5%)
Homa Bay	312,108	140,016	119,163(85.1%)	14,405	13,433 (93.3%)
Total	**1,001,587**	**460,447**	**414,467 (90%)**	**51,169**	**48,899 (95.6%)**

Appendix G: 2011 Mapping Data by District

Table G-1: Migori District Mapping Data 2011

Division	Total Population	No. of Children under 5	No. of Pregnant Women	Total ITNs	No. of Eligible Structures
Karungu	32,700	7,447	572	3,994	11,334
Muhuru	34,756	8,969	883	5,871	11,375
Nyatike	56,335	13,419	1,468	8,955	17,966
Awendo	102,440	22,356	1,579	19,372	39,584
Rongo	73,739	16,254	1,002	14,019	25,138
Suba Central	52,890	13,308	1,219	12,276	16,083
Suba East	42,195	10,220	1,040	7,187	13,523
Suba West	54,140	15,141	1,208	8,071	16,770
Oyani	35,164	8,111	737	5,667	10,220
Uriri	62,005	14,264	1,557	8,866	18,271
Total	**546,364**	**129,489**	**11,265**	**94,278**	**180,264**

Table G-2: Nyando District Mapping Data 2011

Division	Total Population	No. of Children under 5	No. of Pregnant Women	Total ITNs	No. of Eligible Structures
Lower Nyakach	53,729	10,215	644	16,583	17,157
Miwani	57,042	12,453	1,121	13,405	19,465
Muhoroni	71,195	16,327	1,360	12,431	24,618
Nyando	71,439	15,693	1,145	21,429	24,204
Upper Nyakach	47,785	9,218	554	7,663	14,676
Total	**301,190**	**63,906**	**4,824**	**71,511**	**100,120**

Table G-3: Rachuonyo District Mapping Data 2011

Division	Total Population	No. of Children under 5	No. of Pregnant Women	Total ITNs	No. of Eligible Structures
East Karachuonyo	89,330	19,259	1,416	21,994	28,063
Kabondo	76,322	16,521	1,376	15,267	23,336
Kasipul	107,740	23,982	1,717	11,722	34,945
West Karachuonyo	59,880	12,619	858	7,567	18,238
Total	**333,272**	**72,381**	**5,367**	**56,550**	**104,582**

Appendix H: IRS Kenya Success Story

Community Role in IRS: Engaging Community Health Workers (CHWs) for Improved Ownership and Acceptance of IRS in Migori

"Malaria cases are on the downward trend, and the vulnerable populations (pregnant women and children under five) have been protected, the community members today go about their daily chores, and our children go to school."
-Elly Onyango, a CHW from Nyatike

CHWs during a Focus Group Discussion (FGD) sharing their experiences and challenges faced during the IRS 2012 operations

"This is the best strategy so far and should be embraced because it helps in building local capacity and retention of knowledge among CHWs"

-Peter Nyang' Public Health Officer, Migori

For Millicent Achieng' of Kanyamgony, in Rongo district, the IRS 2012 operation has come as a blessing. "Before the start of IRS in our community, my children frequently suffered from malaria," she said, adding that this led to "countless journeys to the hospital, where long queues awaited," not to mention "the money spent on buying drugs."

These difficulties are now over, and today, the mother of three attests to the success of the IRS program. "Since the house was sprayed, such cases of Malaria have become a thing of the past." Millicent says, "may God bless the people giving out the money to undertake the intervention which protects my community against malaria."

The success of IRS operations in Migori district has been largely attributed to the RTI/MOPH strategy of using existing local structures—such as local leadership, and engaging women's groups and CHWs—to conduct community mobilization. This approach was effective in promoting the project's objectives and attracting buy-in, which led to high acceptance of IRS among community members. The use of CHWs for mobilization in Migori proved successful and was highly welcome by the community. The mobilization teams worked within a short time period and were always available to the households. The community members' familiarity with the mobilization staff, enhanced community trust in the information they disseminated. "This is the best strategy so far and should be embraced because it helps in building local capacity and retention of knowledge among community members," says Peter Nyang', Migori Public Health Officer. "Because of this new mobilization strategy, incidences of household refusals have not been witnessed this time around as they were in the previous rounds."

“Indeed, working within a short period of time and reaching 93% of the total populations through household registration coupled with proper information, education, and communication to the target community is really laudable,” noted Mr. Henry Ochiel, a District Public Health Officer in Migori.

IRS beneficiaries have continued to praise the campaign; the provincial administration fully participated by mobilizing the community to accept IRS and even took a leading role in mobilization data verification. “We appreciate the efforts of PMI/USAID and the Government of Kenya for this intervention. I am really happy that my community is protected against malaria,” comments Erick Mala, Chief South East Kamagambo.

Most community members reaffirmed their commitment to support IRS. Mr. Midianga Odingo Ndinya, an ardent supporter of IRS from Awendo Division, pointed out with great enthusiasm their role as community members: “We as a community are committed to ensuring IRS is successful.”

Elly Onyango, a CHW from Nyatike District, was quick to add that “this is a good intervention that should be conducted twice a year to ensure year-round protection.” She continued, “Malaria cases are on the downward trend, and the vulnerable populations (pregnant women and children under five) have been protected; the community members today go about their daily chores and our children go to school.”

Spraying households of the Legion Maria sect members previously presented a challenge for spray operators because of the sect’s strong religious beliefs. However, during IRS 2012, the project recruited a spray operator from among their membership. Patricia Adhiambo Omollo, who hails from God Kwer in Suba West Division, Migori District, managed to mobilize her fellow members and get their houses sprayed. “I am very glad today because my people listened to me to allow their houses to be sprayed, and I feel motivated as a spray team leader,” Patricia comments. “Today malaria, which has always been a burden to us, is on the downward trend.” This approach and concerted effort from the local leaders and the community has indeed helped to protect a large population against malaria, with an overall coverage rate of 98% for the 2012 IRS round.