



PRESIDENT'S MALARIA INITIATIVE



INDOOR RESIDUAL SPRAYING FOR MALARIA CONTROL

Ghana Spraying Performance Report

Indoor Residual Spraying (IRS 2) Task Order One

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Abbreviations

ACTs	artemisinin-based combination therapies
AGA	AngloGold Ashanti
BCC	behavior change communication
CA-USA	Crown Agents USA, Inc.
CBS	community-based surveillance
CDC	U.S. Center for Disease Control and Prevention
COP	Chief of Party
DHMT	District Health Management Team
DOM	district operations manager
EIR	entomological inoculation rate
EPA	U.S. Environmental Protection Agency
FY	Fiscal Year
GF	Global Fund
GHS	Ghana Health Service
GILLBT	Ghana Institute of Linguistics, Literacy, and Bible Translation
IEC	information, education, and communication
IPT	intermittent preventive treatment
IRS	indoor residual spraying
ITN	insecticide-treated net
KCCR	Kumasi Centre for Collaborative Research
LPM	live presenter mentions
M&E	monitoring and evaluation
MARA	Mapping malaria risk in Africa
MaVCOC	Malaria Vector Control Oversight Committee
MOH	Ministry of Health
MOP	malaria operational plan
NMCP	National Malaria Control Program
NMIMR	Noguchi Memorial Institute for Medical Research, Ghana
NRO	Nairobi Regional Office
PMI	United States President's Malaria Initiative
PPE	personal protective equipment

ProMPT	Promoting Malaria Prevention and Treatment Project
SHEP	School Health Education Program
SOP	standard operational procedures
STTA	short-term technical assistance
TOT	training of trainers
USAID	United States Agency for International Development

1. Executive Summary

The Indoor Residual Spraying (IRS) for malaria control project is in its fourth year of operations in Ghana. In December 2006, Ghana was selected as one of the 15 beneficiary countries in sub-Saharan Africa to benefit from a five-year, \$1.2 billion initiative to help scale up malaria treatment and prevention interventions in higher burden countries, known as the United States President's Malaria Initiative (PMI)

PMI supported Ghana with funding to implement IRS in 2008. The United States government is assisting the Ghana Health Service/National Malaria Control Program (NMCP) under the Ministry of Health (MOH) to expand the use of IRS in the prevention and control of malaria. The goal of PMI is to achieve 85% coverage of use of artemisinin-based combination therapies (ACTs) in the treatment of malaria, prevention through the use of insecticide-treated nets (ITNs), intermittent preventive treatment (IPT) for pregnant women, and IRS to reduce malaria-related mortality by 50% in 70% of the at-risk populations in sub-Saharan Africa. PMI has continued to support NMCP in achieving high coverage levels of IRS, to ensure that malaria transmission levels are reduced substantially while continuously expanding the capacity of NMCP to plan, monitor, and execute IRS programs. Technical, operational, managerial, and commodity support for IRS is provided by PMI in partnership with NMCP.

Consistent with RTI International's Ghana IRS practice, all activities were preceded by several microplanning meetings with relevant stakeholders in all nine districts to obtain inputs for the IRS operational plan. The regional health directorate and district assemblies played lead roles in organizing and holding these meetings. Operational and logistics needs assessments were undertaken to determine the requirements for 2011 operations. Throughout the year, several technical and administrative review meetings were organized in Accra and Tamale to fine tune preparations for the fourth round of IRS spray operations. The District Health Management Teams (DHMTs) and the district assemblies assisted RTI in securing office space, warehouses, stores, and accommodations for IRS operations in all nine operational districts. Some of these facilities had to be renovated and refurbished to make them suitable for use.

The first round of IRS in 2008 targeted the five districts of Gushegu, Karaga, Savelugu-Nanton, Tolon-Kumbungu, and West Mamprusi, protecting more than 601,000 people. A sixth district, East Mamprusi was added in 2009 as part of the expansion efforts, with more than 708,000 residents protected. In 2010, PMI supported IRS in these six districts and expanded to include the two new districts of Chereponi and Saboba, protecting more than 800,000 persons. The 2011 IRS campaign saw a further scale-up of the PMI-sponsored IRS operations from eight to nine beneficiary districts to include the Bunkpurugu-Yunyoo district after conducting successful baseline entomological and epidemiologic studies in 2010. A total population of approximately 950,000 persons was targeted to be protected by the 2011 IRS operations. RTI conducted geographic and logistics reconnaissance visits to all nine IRS beneficiary districts to assess their level of preparedness for the 2011 IRS

operations. Observations and recommendations from such visits were incorporated into the work plan.

The 2011 IRS spray operations started simultaneously in all 31 operational sites across the nine districts on May 2, 2011, and ended on July 31, 2011. Community mobilization and information, education, and communication (IEC) activities commenced one month prior to the spray operations across all nine targeted districts, with the registration of houses and distribution of IRS cards according to the IRS operational plan.

At the end of spray operations, data from all nine districts indicated that a total population of 926,699 residents was protected. Moreover, a total of 354,207 structures were sprayed out of the 383,018 eligible structures found, representing an achievement of 92% coverage.

Out of the protected population, 188,696 were children under five and 21,774 were pregnant women. The Ghana IRS Project found a total of 185,249 ITNs in the nine districts, and 14,319 pregnant women and 133,572 children under five had slept under an ITN the night before spraying was conducted. A total of 78,873 insecticide sachets were used during this IRS campaign.

The major challenges confronting the IRS project continue to be the poor road conditions, hard-to-reach communities, early onset of the rains, long travelling times, and dispersed communities. Other challenges included unreliable district and subdistrict data and the frequent political and ethnic tensions in the region.

As part of the district demobilization efforts, a regional post-spray evaluation meeting was held at the Ghana Institute of Linguistics, Literacy, and Bible Translation (GILLBT) Training Center in Tamale on August 16, 2011, to evaluate the 2011 IRS operations and also to receive feedback and recommendations for improving future IRS rounds. Notable participants included the PMI/U.S. Centers for Disease Control and Prevention (CDC) Advisor; staff from NMCP, Noguchi Memorial Institute for Medical Research, Ghana Health Service (GHS), U.S. Environmental Protection Agency (EPA), Kumasi Centre for Collaborative Research (KCCR), DHMT, and district assemblies; the media; and traditional leaders from the beneficiary districts.

2. Country Background

Ghana was chosen as one of the 15 African countries to receive funding under PMI. In 2007, RTI was selected by the United States Agency for International Development (USAID) as the prime contractor for the PMI-funded Indoor Residual Spraying 1 (IRS 1) Task Order One. The PMI-supported IRS implementation began in 2008. In September 2009, RTI was awarded the IRS 2 Task Order One follow-on project for the continued implementation of IRS in sub-Saharan Africa. The purpose of IRS 2 Task Order One was to support PMI, USAID Missions, and the NMCP in planning and implementing IRS programs with the overall goal of reducing the burden of malaria in Africa.

RTI is working with its subcontractors and international partners, Crown Agents USA (CA-USA) for procurement and logistics services, and the Meridian Group International for IEC/behavior change communication (BCC) strategies. In Ghana, RTI subcontracts with the Noguchi Memorial Institute for Medical Research (NMIMR) for ongoing entomologic monitoring and capacity building efforts, as well as for conducting an operations research survey on prevalence of anemia the fourth year of the PMI-supported IRS operations.

PMI is committed to working closely with host governments and within existing national malaria control plans. The PMI-supported IRS project provides strategic, technical, management, and operational support to implement the NMCP's and USAID's goal of reducing malaria-associated mortality in the selected IRS districts. Coverage for the fourth round of IRS operations was estimated to reach a population of approximately 950,000 residents with the objective of improving IEC activities to increase community participation and acceptance. Adequate planning and proper organization of work schedules enabled the in-country IRS staff to work effectively with partners and stakeholders, manage resources prudently, and facilitate the IRS project effectively and smoothly at the district level to attain high quality standards.

Specific support for IRS implementation for fiscal year 2011 included the following:

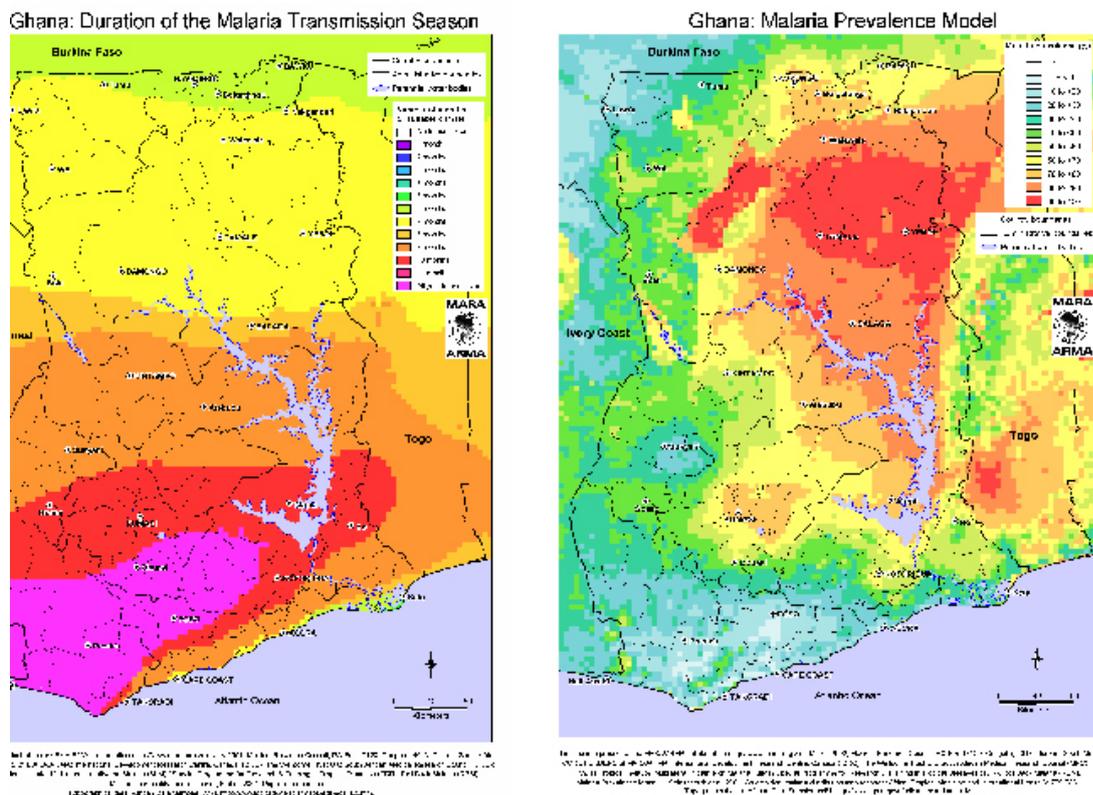
- Procurement of insecticide and equipment for IRS through a competitive solicitation process
- Technical and financial support for IRS operations for a targeted population of about 950,000 people. Various trainings were conducted for 381 spray operators, 94 team leaders, 31 supervisors, 30 site managers, 369 IEC implementers, 22 storekeepers, 60 wash persons, 60 water suppliers, 30 pump mechanics, 30 site managers, 4,338 community-based surveillance (CBS) volunteers, 55 drivers, and assembly members and opinion leaders of the beneficiary districts
- Support for environmental assessments and monitoring per the U.S. 22 Code of Federal Regulations 216 and the establishment of capacity for best practices in the target districts for insecticide handling and usage for IRS
- Technical support for program planning and implementation, data collection, protocol and guideline development, IEC, and logistics capacity for IRS
- Financial and technical support for entomological monitoring, including evaluation of insecticide resistance to generate critical data on the efficiency and effectiveness of the spraying program and potency of the insecticide to be used for vector control
- Collaborating with GHS/NMCP, NMIMR, and CDC in conducting two rounds of the anemia and parasitemia prevalence study in an effort to capture data on the public health impact of IRS

This spraying performance report summarizes the activities, achievements, and lessons learned for the fourth round of spray activities and recommendations to improve future IRS activities. It also highlights the progress made toward achieving PMI's objectives in Ghana.

2.1 Malaria Transmission and Burden

Malaria is hyper-endemic in all parts of Ghana, with the entire population of 24 million persons at risk. It is the number one cause of morbidity, accounting for approximately 37.5% of all outpatient attendance. It is also the leading cause of mortality in children under age five, a significant cause of adult morbidity, and the leading cause of workdays lost due to illnesses. Figure 1 contains maps that show the malaria transmission season (left) and prevalence model in Ghana by region (right). Malaria transmission occurs year round, with slight seasonal variations during the rainy season, from April to July. There is marked seasonal variation in the northern parts of Ghana, where there is a prolonged dry season from September to April.

Figure 1: Ghana Malaria Transmission Season and Prevalence Model



Source: MARA/ARMA, http://www.mara.org.za/mapsdownltab_pdf.htm

2.1.1 Selection Criteria

Based on the preceding information, the NMCP and PMI cited the following factors in justifying IRS operations in the northern region of Ghana:

- *Disease burden:* High malaria prevalence in beneficiary groups
- *Epidemiology:* Pronounced seasonal peak, spraying can be done once per year
- *Feasibility:* Logistics and financial assessment

2.2 National Malaria Strategy

On vector control, the NMCP aims for a comprehensive approach, using a combination of ITNs and IRS. Greater emphasis may be placed on one or the other in various districts, depending on the epidemiological setting and availability of funds. The NMCP supports the use of complementary methods such as larviciding and environmental management. Mass larviciding (i.e., outdoor residual spraying) is not considered cost-effective or feasible in a hyperendemic country like Ghana, except in well-defined and targeted areas.

Other key elements of the National Strategic Malaria Control Plan are to

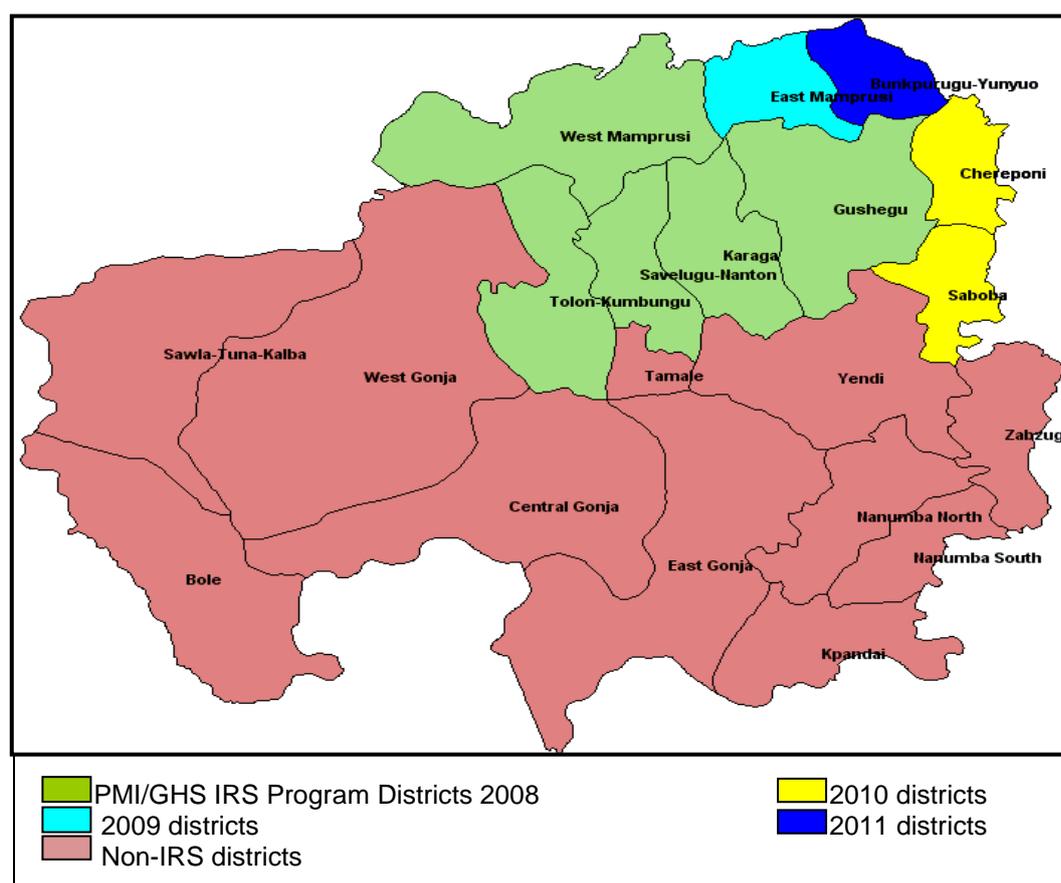
- Strengthen monitoring and evaluation (M&E) and operational research
- Strengthen the health systems that deliver malaria services at all levels
- Create and sustain partnerships for malaria control
- Create awareness among the community as well as the health workforce on malaria control and prevention activities
- Forge functional partnerships and mechanisms between departments and programs within and outside the health sector

2.3 District Selection

The government of Ghana, through the GHS/NMCP, proposed to start IRS activities in an area where they would have maximum impact and demonstrate both the efficacy and sustainability of the program in the shortest possible time. The selection criteria included the following:

- An area where transmission was predominantly seasonal and could be successfully interrupted through minimizing the longevity of the female *Anopheles* mosquitoes (*An. gambiae* mosquitoes account for more than 90% of all anophelines.)
- An area with a high disease and mortality burden for which a 50% reduction over the next three years is possible
- An area where vectors are sensitive to the selected pesticide
- An area with indoor-resting *Anopheles* vectors that are also endophagic
- An area with a population that would match the available resources proposed for the IRS activities

Figure 2: District Map of Northern Region



3. Preparation for IRS

The Ghana IRS project, in line with its work plan objectives, formulated unique and appropriate standard operating procedures (SOPs) to serve as a roadmap for its operational activities, including IRS planning, implementation, logistics support, M&E, environmental compliance, and epidemiological and entomological activities. A critical component of the 2011 work plan objectives is the provision of strategic and technical support to build in-country capacity at all levels and ensure the correct application of IRS and the sustainability of IRS operations.

The Ghana IRS 2011 work plan and budget was revised in accordance with the comments, recommendations, and suggestions received from local partners and stakeholders, the Contracting Officer’s Technical Representative, and the USAID/PMI/CDC team. The Ghana work plan was approved by PMI/USAID Ghana Mission on March 8, 2011.

3.1 Geographic Reconnaissance

In 2011, the team undertook reconnaissance visits in the operations sites and beneficiary communities to offer the IRS team the opportunity to acquire vital and detailed information on the selected districts, with a lot of attention and emphasis on the new district, Bunkpurugu-Yunyoo district. The Bunkpurugu-Yunyoo district was

identified to be an area with both a seasonal transmission pattern and a high disease burden.

3.2 Environmental Assessment

The environmental assessment is an extension of the IRS project's concern to ensure the safety of the environment, animals, and humans from the effects of insecticide exposure. A team consisting of EPA and GHS officials and RTI undertook joint pre-spray environmental assessment and compliance inspections from April 24 to May 1, 2011, to all nine districts and assessed the level of preparedness for spray operations. Before the start of the spray operations, new, modernized soak pits were constructed at all 31 operational sites and included reinforced wire mesh fencing, doors, and locks. All other refurbishment work on the operational sites was completed in time for the commencement of spray operations.



COP and Logistics Officer in Tolon inspecting rehabilitated soak pit with wire mesh fencing

3.3 Logistics Needs Assessment

The Ghana IRS team conducted logistics assessments through reconnaissance visits to the targeted districts; met with regional and district stakeholders; conducted a survey on storage facilities, human resource requirements, and operational arrangements; and determined the level of financial resources required for the implementation of 2011 spray operations.

RTI based its logistics plan on experiences from previous spray rounds (which served as benchmarks for planning the 2011 IRS spray operations), with more intensive logistics assessment in the new district targeted for 2011 IRS operations, Bunkpurugu-Yunyoo.

3.3.1 Warehouse Location and Use

The RTI main warehouse is located in Tamale, within the premises of the Northern Regional Central Medical Stores. This facility was made available to the RTI team based on the collaboration established with the GHS. Offices and warehouses that were obtained for use in the operational districts during the previous spray rounds were inspected and refurbished to be used during the 2011 spray operations. Additional offices and warehouses were obtained for use in the new district of Bunkpurugu-Yunyoo. The warehouses were located far away from residential facilities to minimize environmental effects of IRS operations on both human and animal health and were secured to prevent theft. Security guards were hired to provide 24-hour protection for each facility in the 31 IRS operational sites throughout the 2011 spray campaign.

All logistics items required for spraying were procured and delivered to the nine districts before commencement of spray operations. A total of 114,240 sachets of insecticides were procured for this fourth round of spray operations, combined with the 2010 balance of 15,205 pyrethroid sachets gave a total of 129,445; and at the end of the spray round, 50,572 remaining sachets were available.

The spray equipment consignment (Hudson pumps and spare parts) was safely received at the Tamale central warehouse on March 21, 2011. The quantities, included in Table 1, were verified by physical counts, and the acceptance report was completed and submitted to CA-USA and RTI Procurement. The RTI/Ghana IRS project also received a consignment of five laptops from the RTI home office to support IRS operations.

Table 1: Spray Operations Material Input

Item	Quantities Received
67422WD X-Pert Pumps	128
Nozzle tips (8002E)	600
Coveralls	480
Rubber boots	168
Spray pump repair kits	27
Pressure gauge assemblies	250
Pump gaskets (XP 151030)	600
Adapter spray tube (XP 115965)	500
Nose mask	52,325
Rubber gloves	8,232
Helmets with face shield	218
Face shield carriers and visors	417
Pregnancy test kits	450

In January 2011, to comply with IRS standard procurement procedures, the RTI team placed in the national daily newspapers a request for bids for the procurement and supply of IEC materials, rental of vehicles, and computers. The team evaluated submitted proposals according to SOPs, selected award recipients, and engaged selected vendors in preparation for IRS operations.

3.4 Insecticide Selection

As specified in the 2010 scope of work, NMIMR and the RTI team analyzed all entomological data collected from the monthly evaluations. At a Malaria Vector Control Oversight Committee (MaVCOC) meeting in December 2010, based on evidence from that analysis, NMIMR recommended selecting pyrethroids as the preferred class of insecticide because it was shown to be most effective and appropriate for use in the 2011 spray round. This decision was based largely on the susceptibility of the local vectors and the insecticide's residual effect. For purposes of agreement, NMIMR, PMI, GHS, NMCP, MaVCOC, and RTI discussed the recommendations from the entomological evaluation results. The NMCP concurred with the recommendations and then issued a letter endorsing the preferred pyrethroid insecticide class for use in 2011, which formed the basis of the procurement process.

In January 2011, with the choice of insecticide class from NMCP and PMI, and with the logistical assessment determining the amount of insecticides, equipment, and

personal protective equipment (PPE) needed for 2011 activities, RTI and its procurement partner, CA-USA, developed a procurement solicitation strategy.

A consignment of 114,240 insecticide sachets (alpha-cypermethrin) for the 2011 spray round arrived safely in Accra, Ghana, on February 23, 2011. The RTI Ghana team worked with the USAID Ghana Mission and CA-USA to successfully process the necessary documentation for customs exemption and clearance. The insecticide was transported and safely discharged into the Tamale central warehouse on March 4, 2011. Under the supervision of the logistics officer, physical count and examination of every insecticide sachet was done. A sample of 10 insecticide sachets from the different batches were selected using the standard IRS SOP and sent to Nairobi for testing and analysis to ensure quality control and quality assurance.

3.5 Human Resource Requirements

IRS operational activities in general are labor intensive and require a sizeable and highly motivated workforce. A thorough and highly competitive recruitment process was conducted to find highly qualified personnel for the 9 full-time district operations manager (DOM) and 1 IEC specialist positions. Existing personnel included the COP, operations manager, finance manager, logistics officer, M&E officer/data manager, office manager, entomologist, administrative assistant, and three drivers.

The newly recruited DOMs and IEC specialist assumed duty on February 7, 2011, and were actively involved in the recruitment of RTI temporary district staff. A total of 47 personnel were recruited for the district positions of district M&E coordinators, finance assistants, logistics assistants, IEC assistants, and data managers. Temporary staff assumed duty on March 9, 2011. A two-day staff training and orientation workshop occurred on March 10–11, 2011 to provide an overview of RTI processes and procedures, IRS operations, community mobilization and community entry approaches, entomology, and other operational procedures and administrative functions for implementing IRS operations at the district level.

Table 2 summarizes the temporary district staff engaged during the 2011 spray round.

Table 2: Temporary Operational Field Staff

Position	Total Staff
District M&E coordinators	10
Finance assistants	9
Logistics assistants	9
IEC assistants	10
Data managers	9
Total	47

3.6 Training

The Ghana IRS team organized several training activities for staff and partners to ensure the smooth implementation of the spray operations at the regional and district levels. These included two regional training of trainers (TOT), IEC assistants training, spray operator training, and IEC implementers training. A poison management training for health prescribers and health care workers and an applied entomology training were also organized. Specific training sessions organized during the period are described in Sections 3.6.1–3.6.7.

3.6.1 Training of Trainers at the Regional Level

In building capacity of district teams to effectively spearhead IRS spray operations, RTI organized two TOT workshops in Tamale. Participants at the first TOT, which occurred on April 11–15, 2011 comprised of DOMs, M&E coordinators, district disease control officers, and district environmental health officers. The second group of TOT participants comprised site managers and supervisors, and their training took place on April 17–22, 2011. A total of 100 individuals were trained. The training aimed to achieve the following:

- Develop essential, hands-on skills and practical knowledge of malaria control programs using IRS
- Ensure that public health workers at the peripheral level are prepared to undertake planning, management, and implementation of effective IRS programs
- Develop mechanisms and strategies for identifying problems and providing solutions in the field in resource-constrained environments
- Ensure that TOT participants can effectively undertake district-level training
- Develop a core pool of trainers who can effectively support and monitor spray activities at the district level



Spray operators practicing insecticide application techniques

3.6.2 Poison Management Training

To build the capacity of health staff, the IRS Ghana team organized a pesticide poisoning management training for 84 participants (34 males and 50 females) staff from the various health posts in all the beneficiary IRS districts. Dr. McAli from the Tamale Teaching Hospital facilitated the two-day training, which took place on May 24–25, 2011, on the early identification and management of insecticide poisoning incidents and related complications. Specifically, Dr. McAli focused on operational protocols for managing accidental insecticide exposure in local health facility setting considering the infrastructure, equipment, and the level of health professionals available at the health centers. The training also provided an overview about the medication that should be stocked at the health centers to treat and manage any accidental exposure.

3.6.3 Spray Operator Training at the District Level

Prospective candidates who had been interviewed and selected by the respective district assemblies and DHMT underwent physical and medical examinations, after which eligible candidates were invited to participate in the district-level spray operator training. District-level spray operator training took place across all nine districts from April 24 to 30, 2011. The training involved both theory and practical sessions, including some of the following topics:

- Preparing households for IRS
- Environmental compliance
- Protecting the safety of the population
- Personal protective equipment (PPE)

- Insecticide application techniques
- Data entry, validation, and verification techniques



Medical examination for prospective spray operators

3.6.4 Driver Training

The IRS team sponsored driver training and vehicle inspections for IRS operations on April 27, 2011, at the RTI office in Tamale. Drivers were trained on defensive driving, reporting procedures, and remedial actions to secure insecticide in case of spillage or accident. Protocols were established with relevant district authorities to facilitate a local response in the unlikely event of spillage. All drivers were trained on the purpose of the IRS operations and safe methods for transporting spray operators and insecticides.

3.6.5 IEC Assistants, IEC Implementers, and CBS Training

The provision of quality IEC to the intended beneficiaries is central to any successful IRS operation. Therefore, IEC assistants were recruited to lead and drive innovative approaches in the IRS information delivery system in the nine operational districts by creating awareness and mobilizing and engaging community members. IEC implementers used participatory approaches that resulted in advocacy, knowledge, and skill transfer to beneficiary communities. The IEC specialist facilitated a two-day training program for the 10 IEC assistants, at the Tamale office on March 23–24, 2011. The purpose of the training was to

- Introduce the team to RTI operations and its mandate in malaria control
- Identify the role and responsibilities of IEC assistants
- Identify IEC strategies and data capture tools
- Effectively supervise and monitor the activities of IEC implementers

Subsequently, cascade training for the IEC implementer in the various districts took place from April 21 to 30, 2011. Other issues were discussed such as the terms of engagement for IEC implementers and engaging CBS volunteers to support IRS activities in their resident communities.

The IEC implementers and CBS training focused on the IRS definition of a structure and the new IRS household card, which replaced both the IEC sticker and spray operator sticker. IEC implementers were also instructed on the community entry and registration processes for head-of-household/landlord and other demographic variables on the IRS household card and the daily IEC report form. Other data capture tools such as the daily activity form were also discussed. A total of 369 IEC implementers were trained in all nine operational districts. Distribution of IEC implementers and CBS volunteers across districts is shown in Table 3; and Table 4 presents the number of temporary spray operations staff trained in all nine districts.

Table 3: District Distribution of IEC Implementers and CBS Volunteers for 2011 Spray Operations

No.	District	No. of IEC Implementers	CBS Volunteers
1	Karaga	35	438
2	Tolon-Kumbungu	45	624
3	Gushegu	45	744
4	Savelugu-Nanton	35	436
5	West Mamprusi	50	316
6	East Mamprusi	40	362
7	Saboba	38	568
8	Chereponi	36	380
9	Bunkpurugu-Yunyoo	45	470
	Total	369	4,338

3.6.6 Data Training

The RTI Ghana team organized a two-week training for data managers on the use of the Microsoft Access database software for data capture on April 12–21, 2011, to help improve IRS data quality, reliability, and validity. The Regional M&E Officer from the RTI Nairobi Regional office, Mrs. Carolyn Njue, facilitated the training with the active support of the RTI Ghana technical team.

Participants were instructed on the basic components of the Access database; practical lessons included creating tables, forms, queries, and reports. Participants received practical, hands-on training on entering and editing data in the database and producing and distributing reports. They were also introduced to the short messaging system for data capture, which is expected to be piloted during the 2011 second spray round in Burkpurug-Yunyoo.

The training also covered the following:

- Review of daily spray cards, daily insecticide tracking and distribution cards, and daily IEC reports
- Editing of the Ghana Access database to correspond with the information to be captured on the data collection cards
- Definition of an IRS structure
- Review of the newly introduced IRS household card

At the end of the training, data managers made the following recommendations for improving the database and making it more user-friendly:

- The database should be designed to correspond with the data cards.
- The database tab system should be set to follow the indicators on the data cards
- Indicators for “Total eligible structures” and “Population in eligible structures” should be added to the daily IEC report.
- The database must be ready before the start of spray operations.

3.6.7 Entomological Training

As part of the training in preparation for all IRS activities, a 10-day entomological training workshop took place in Tamale from August 21 to 31, 2011, to build regional capacity of selected staff from the GHS, the district assemblies, and RTI district staff to assist in entomological monitoring of the IRS project in the Northern Region. NMIMR staff trained 40 participants on applied entomological techniques to improve their outreach to IRS targeted communities and assist in entomological monitoring operations in future spray rounds.

Table 4: Temporary Spray Operations and Auxiliary Staff

Position	Savelugu-Nanton	Tolon /Kumbungu	Gushegu	Karaga	West Mamprusi	East Mamprusi	Saboba	Chereponi	Bunkpurugu-Yunyoo	Total
Spray operators	44	64	36	25	56	48	30	30	48	381
Team leaders	11	16	9	6	14	12	7	7	12	94
Supervisors	4	5	3	2	5	3	3	2	4	31

Position	Savelugu-Nanton	Tolon /Kumbungu	Gushegu	Karaga	West Mamprusi	East Mamprusi	Saboba	Chereponi	Bunkpurugu-Yunyoo	Total
Security guards	6	10	6	4	10	6	6	4	8	60
Washers	6	10	6	4	10	6	6	4	8	60
Water suppliers	6	10	6	4	10	6	6	4	8	60
IEC implementers	35	45	45	35	50	40	38	36	45	369
Storekeepers	2	4	2	2	4	2	2	1	3	22
Pump mechanics	3	5	3	2	5	3	3	2	4	30
Site managers	3	5	3	2	5	3	3	2	4	30
Drivers	7	7	6	4	8	7	5	4	7	55
Total	127	181	125	90	177	136	109	96	151	1,192

4. IEC Activities and Community Mobilization

The acceptance, success, and sustainability of the IRS program depend heavily on the involvement of key stakeholders and beneficiaries. To increase this involvement, the IRS IEC and community mobilization efforts, led by RTI in conjunction with GHS, included stakeholder meetings to brief community leaders and gatekeepers about the IRS program. The meetings also sensitized beneficiaries on the need for their participation and collaboration, as well as their expected roles before, during, and after the spray activities. Table 5 provides counts of the number of participants at these meetings for all districts and subdistricts in 2011.

4.1 District Stakeholders Meeting

Stakeholder meetings were held throughout the nine operational districts from March 31 to April 7, 2011. Participants discussed their district-specific malaria situation and also shared their experiences with IRS from the previous spray rounds. The meetings also served to officially launch the fourth round of IRS operations in all districts. In Bunkpurugu-Yunyoo, the new IRS district, the district assembly, chiefs, and community members expressed their enthusiasm for the IRS campaign and committed to give the IRS team its maximum support and cooperation.

Overall, participants at these stakeholder meetings were drawn from the respective district assembly and its decentralized departments, including the district chief executives, district coordinating directors, chiefs, opinion leaders, religious leaders, and assembly members. Also in attendance were representatives from the DHMT, National Health Insurance Scheme, and food and fuel vendors. Other participants included youth leaders, women’s groups, and security forces, including the police, fire prevention personnel, and immigration services.

Similar stakeholder meetings were organized at the subdistrict level and featured greater community participation, including two community-based health volunteers from each community, the IEC implementers within the zone, chiefs, assembly members, and women leaders. Participants were educated and sensitized on IRS operations and the need to keep and preserve the IRS household card for use during future spray rounds. They were also reminded of their expected roles in facilitating IRS in their respective communities. Stakeholder participation and community responses to these meetings were positive and encouraging.

As partners in health, GHS remains our strongest partner, and hence the need for constant dialogue and collaboration with GHS on IRS activities at all levels. The health staff frequently lends support to the IRS district team, especially with providing sensitization on IRS at the health centers. This collaboration extends beyond the health facility and into the larger community. As part of the district IRS monitoring team, these health staff supervise daily spraying activities and address any challenges encountered in the field—particularly the challenge of convincing residents who refuse spraying that IRS is an important intervention in preventing malaria.

Table 5: Community Mobilization for Pre-IRS Operations: Participant Information at Various Stakeholders Meetings

District	Subdistrict	No. of Participants		
		Male	Female	Total
Karaga	Sandua	51	57	108
	Zandua	35	26	61
	Karaga	69	13	82
	Pishigu	82	15	97
	Total	237	111	348
Tolon-Kumbungu	Tolon	86	101	187
	Dalun	73	70	143
	Kumbungu	62	84	146
	Nyankpala	52	94	146
	Wantugu	82	74	156

District	Subdistrict	No. of Participants		
		Male	Female	Total
	Kpendua	34	23	57
	Total	419	416	835
Gushiegu	Gushiegu	227	172	399
	Nabuli	138	112	250
	Galwei	82	59	141
	Total	447	343	790
Savelugu-Nanton	Pong-Tamale	48	25	73
	Savelugu	96	67	163
	Diare	52	29	81
	Nanton	76	47	123
	Tampion	63	41	104
	Total	335	209	544
West Mamprusi	Walewale	115	20	135
	Kpasenkpe	86	35	121
	Janga	55	40	95
	Yizesi	50	28	78
	Kubori	63	45	108
	Total	369	168	537
East Mamprusi	Langbinsi	126	24	150
	Sakogu	112	12	124
	Gambaga	109	12	121
	Nalerigu	72	33	105
	Gbintri	103	54	157
	Total	522	135	657
Saboba	Saboba	140	114	254
	Wapuli	98	98	196
	Sambuli	91	70	161
	Total	329	282	611

District	Subdistrict	No. of Participants		
		Male	Female	Total
Chereponi	Chereponi	65	20	85
	Wenchiki	35	15	50
	Tombu	21	10	31
	Garinkuka	19	10	29
	Total	140	55	195
Bunkpurugu-Yunyoo	Bunkpurugu	58	33	91
	Binde	48	23	71
	Nakpanduri	62	17	79
	Yunyoo	36	19	55
	Nasuan	47	22	69
	Total	251	114	365
Total		3,049	1,833	4,882

4.2 IEC Materials

The posters and brochures from previous rounds were reviewed and updated to support 2011 IRS operations. A new IRS household card was introduced to replace the IEC sticker and the spray operator sticker; and this new card can be used for a period of about four years. Table 6 provides amounts of IEC materials produced and distributed in 2011.

- The IRS project used three different sets of posters:
 - 1) Welcome the Spray Operator: This poster shows a spray operator dressed in PPE arriving at a home and being welcomed by the head of the household. It appeals to community members to accept IRS.
 - 2) IRS Steps: This poster outlines the various steps that must be followed before, during, and after spraying
 - 3) IRS Keeps Your Home Malaria Free: This poster shows a spray operator spraying the inner walls of a house
- Brochures: An informational brochure explaining the steps involved in IRS, the intended benefits of IRS, and the expected role of household members in IRS was also used during the in-school sensitization sessions and for the literate populations.
- The IRS Household card: This new card replaced the IEC sticker and the spray operator sticker. Each IRS household card has a unique serial number. The IEC implementer registers the name of the landlord or household head on both

the IRS card and the daily IEC report form. The unique serial number on the IRS household card is recorded on the IEC report form and written on a portion of the wall in the compound, enabling spray operators to record the unique serial number and also cross-check that the IEC implementer has correctly captured the requisite information on the house. After sensitizing the compound/household members, the IEC implementer gives the IRS household card to the landlord or household head, and he or she is reminded to keep the card secure and safe. During spraying, the spray operators and supervisors request the IRS household card, record the necessary information, and sign the card.

To prevent community fatigue in the IRS districts, the program focused more on focus groups in the schools and womens' groups to engage and interact with the communities and to answer questions. Engagement of CBS volunteers was sought as a strategy to more closely involve the community members to spread the IRS messages. A strong collaboration and partnership exists between RTI and the district assemblies, chiefs, and other opinion leaders, including women's groups. In most peri-urban communities, the chiefs ordered the beating of the *gongon* to remind residents about the IRS campaign, and the chiefs encouraged all community members to allow spray operators to apply insecticide to their rooms. This strategy ensured active participation of the entire community in the spraying exercise, built community ownership of IRS, and promoted acceptance of the IRS project.

Table 6: IEC Materials

Item	No. Printed	No. Distributed
IRS household cards	100,000	95,850
Posters		
• Welcome the Spray Operator	20,000	19,120
• Malaria Free		
• IRS Steps	20,000	18,775
	20,000	16,440
Brochures	30,000	28,300
T-Shirts	1,000	1,000
Polo Shirts	1,000	1,000
Baseball Caps	1,000	1,000

4.3 IEC Activities

One of the core components of the IRS project is IEC, which informs and educates the beneficiary communities about the IRS program. The IEC team used several activities and strategies to reach the targeted audience and beneficiary communities.

4.3.1 Community Meetings

Community meetings were organized by the IEC assistants and implementers in all nine IRS districts. They briefed the gatekeepers, opinion leaders, and community members on IRS operations, the benefits of IRS, and their expected roles and responsibilities as a collective effort in fighting malaria. In all these meetings, very influential community leaders who are supportive of the IRS activities addressed the audience, sharing their experiences and entreating all to embrace IRS by allowing their rooms to be sprayed. Members of the household were asked to be present to welcome the spray operator and observe the mixing of the insecticide, thereby ensuring that community members are part of the monitoring process. Community members were again entreated to re-hang and sleep in the ITNs after spraying, stating that malaria prevention required an integrative approach including the use of ITNs, the use of the recommended malaria medications (ACTs), IPT in pregnancy, and IRS. IRS information materials such as posters and brochures were distributed and thoroughly explained to the community members.

4.3.2 Door-to-Door Sensitization

IEC implementers and community health volunteers continued to carry out door-to-door sensitization and education on IRS aimed at sustaining the level of awareness of the role of IRS in malaria control. Education and sensitization also centered on household's roles and responsibilities before, during, and after spraying in their respective communities. For instance, IEC implementers and CBS volunteers informed community members of the date and time of spraying as well as the demarcation of large communities into smaller segments for effective spray operations.

Another strategy was to engage already mobilized groups of young men and women found in the community; e.g., artisans, women in shea nut-processing cooperatives, etc. This strategy helped the IRS team to identify with the community members and ensured trust and openness. This approach also helped IEC implementers and CBS volunteers to identify and address rumors, myths, and misconceptions about malaria and other issues concerning community perceptions of IRS that impeded smooth spraying operations.

4.3.3 In-School IRS Sensitization

In-school sensitization activities on IRS have been a major strategy for disseminating IRS information to beneficiaries. In consultation with the School Health Education Program (SHEP) coordinators and school heads, IRS district teams visited a number of educational institutions in the nine districts, where they were given access to address the entire school population on IRS and its benefits in malaria control. The students were encouraged to serve as ambassadors of IRS and also as change agents in their schools and communities. The district teams made further arrangements with the authorities of second-cycle boarding schools and with other state institutions and organized bodies in the districts to have their structures sprayed. IEC materials were distributed to the students, teachers, and school administrators to provide them with more insight on the program and to equip them with IRS information to share with

their peers and members of their communities. Table 7 provides the number of students, by gender, who participated in these activities in each district.



Students listening to a message on IRS during an in-school sensitization session

Table 7: Number of Students Reached through In-School IRS Sensitization, by Gender and District

District	No. of Schools	No. of students		
		Male	Female	Total
Gender				
Karaga	10	1,504	1,038	2,542
Gushegu	10	2,692	1,818	4,510
Savelugu-Nanton	18	3,203	2,100	5,303
Tolon-Kumbungu	19	3,257	2,079	5,336
West Mamprusi	3	380	535	915
East Mamprusi	13	1,048	1,122	2,170
Saboba	3	340	230	570
Chereponi	15	1,372	1,172	2,544
Bunkpurugu-Yunyoo	3	1,473	1,277	2,750
Total	94	15,269	11,371	26,640

4.3.4 Radio Broadcasts

As part of the information dissemination process, the RTI Ghana team partnered with a number of local radio stations to broadcast IRS sensitization messages to their audience. A total of 16 live radio discussion sessions and 186 public service

announcements/advertisements were aired on Radio Justice and Simli Radio in Tamale to educate listeners on IRS operations. Listeners were given the opportunity to phone in during the discussions to ask questions or contribute to discussions about the IRS project. Calls received were from both beneficiary and non-IRS districts, and all concerns raised were appropriately addressed. The IEC specialist, operations manager, and entomologist and district operations managers served as the resource persons.

One radio station, Radio Gaaki in the Saboba district, with broadcast coverage extending to Chereponi and Gushegu districts, was instrumental in playing the IRS jingles and live presenter mentions (LPMs). In Karaga, a community public address system with a wide coverage was used to deliver IRS information to community members. Interestingly, a spray operator who also doubles as a radio presenter on Simli Radio in his LPMs educated listeners on IRS and reminded beneficiary communities scheduled to be sprayed to be ready for the spray operators by moving items out of their rooms.

4.4 End-of-Spray IEC Activities

RTI Ghana organized a post-spray evaluation meeting at the GILLBT Training Centre on August 16, 2011, to evaluate 2011 spray operations and explore ways of improving IRS operations in future years. Staff from PMI/CDC, NMCP, and GHS comprising district disease control officers and district directors of health services. Other participants included EPA staff, district environmental health officers, traditional leaders, representatives of NMIMR, Chirano Malaria Control project, AngloGold Malaria Control project, and the KCCR. Other participants were from the Catholic Relief Services and the World Food Program. RTI was represented by all nine district operations managers, 10 M&E coordinators, and the Tamale technical team, including the logistics officer, entomologist, IEC specialist, operations manager, and the COP.

At the end of the spray operations, a demobilization plan was developed and discussed with stakeholders, and the district teams visited all stakeholders to thank them for their continued support and assistance during the spray operations. An inventory of all IRS materials used by each district was prepared and reconciled with the regional logistics officer.

5. IRS Results (Monitoring and Evaluation)

The primary objective of the RTI M&E system is to put in place a sustained and efficient data flow system that ensures accurate and timely information from the field (the primary data source being the daily spray operator card) to the central level for decision making and appropriate action. For this fourth round of spray operations, a lot of focus and attention was given to the M&E component because of the introduction of new data capture tools. Monitoring teams composed of the RTI regional team, representatives from the regional health directorate and EPA closely monitored and tracked all indicators outlined in the SOPs. The teams' activities strictly adhered to a monitoring plan and schedule. At the district level, the RTI

district team, in conjunction with the DHMT and the district assembly, monitored spray operations.

5.1 Data Verification and Validation Process

RTI put in place a rigorous data verification and validation process during the spray round. This process included cross-checking the information captured by the spray operator and the IEC implementer to ensure that the information recorded on the daily spray card and the IRS household card adequately reflected the correct information for the house visited and that the information was accurate and consistent with what was subsequently entered into the Access database.

To achieve reliable, accurate, and consistent data, RTI used different strategies at all levels in the verification of the 2011 IRS data. These included the following:

- To eliminate the different kinds of errors associated with the use of the Excel database in the previous spray rounds (2008 to 2010). The Ghana IRS project introduced Access software and database for data capture in the 2011 spray round. This is a robust and more secure database that restricts access to only authorized and trained personnel. The Excel database used in earlier rounds allowed various forms of errors to be introduced at the different levels of the data transfer process. In 2011, RTI's regional quality assurance manager from Nairobi RTI conducted training for data assistants from all nine districts and for RTI Ghana's M&E officer. This training took place from April 12 to 21, 2011. The district data managers/assistants, assisted by the RTI M&E officer, IEC specialist, operations manager, and COP then organized cascade training for spray operators and IEC implementers in all the IRS districts. At each level of supervision, the requisite personnel were assigned the responsibility for ensuring data quality. This was strictly enforced at all the various levels as follows:
 - Data verification by team leaders
 - Data verification by supervisors and site managers
 - Data verification by IRS personnel
 - Data verification by data managers
 - Inter-district data verification
 - Manual computation of IRS data indicators and totals
 - Data verification by querying spray operator daily coverage
 - Data capturing was done from the primary data source (spray operator card), eliminating any possible errors made by the team leader or supervisor

5.1.1 Team Leader Data Verification

The IRS data verification began in the field while spraying was being done. Team leaders, who supervised and monitored the work of the spray operators in the field, were the first persons to verify (on-the-spot verification) any information captured by

the spray operators. Each team leader was responsible for supervising four spray operators in the field. They cross-checked any information captured on the spray operator's daily spray card to ensure it was representative and a true reflection of the compounds visited by the spray operators. The team leader verified all four operators' data by validating from each house the information that the spray operators had captured. Having been convinced and satisfied that the information on the cards was accurate, the team leaders then summarized the information into the team leader summary card. The team leaders also ensured that whenever spray operators went to more than one community on a particular day, spray operator used separate cards for each community visited; thus information from more than one community was never combined on one card. This team leader summary card therefore served as a reference check for the data manager during data entry to ensure that the right totals had been entered into the database.

5.1.2 Verification by Supervisors and Site Managers

During the 2011 spray round, monitoring and supervision of IRS operations were intensified at all levels. RTI ensured that aside from the verification by the team leaders, supervisors also went into the field with spray operators. Each supervisor was responsible for monitoring the work of four team leaders and 16 spray operators. In the field, supervisors sampled 20% of compounds sprayed by the spray operators and verified whether the information captured by the spray operators were accurate for the sprayed structure. They did this by checking the IRS household card (looking at indicators) given to the head of the house by the IEC implementers and verifying whether the information captured by the IEC implementer corresponded with information the spray operator collected. Supervisors also administered a questionnaire (performance assessment tool) to a sample of the houses visited. The information captured by the supervisors was compared with that of the spray operators to ensure consistency. Every IRS household card found in a structure was completed by the spray operator and co-signed by the supervisor.

At the site level, site managers were tasked to verify all of the spray operators' daily spray cards before onward submission to the district data assistant. This verification was done on a daily basis.

5.1.3 Verification by District Data Managers

RTI ensured that only district data assistants and the M&E officer had access to the database and were responsible for entering the data. Before entering the data, they verified the information on the cards to ensure that the data were correctly recorded with regards to structures found, structures sprayed, and structures not sprayed. The data managers also cross-checked to ensure that the number of rooms and structures were correctly recorded. They cross-checked with logistics assistants and storekeepers to ensure that the number of insecticide sachets issued and returned and the number of empty sachets received matched with the number of sachets the spray operators reported using on the daily spray cards. In instances where data were not consistent, spray operators were sent back into the field by the district M&E coordinators to

verify the information. Data managers also sampled some of the cards and checked their summaries before entering all cards.

5.1.4 Verification by IRS Personnel

As part of the data verification system, members of the RTI IRS regional staff also took part and monitored the data process at the various levels. Spray operators' cards are audited on a regular basis to ensure quality across the project. M&E coordinators/managers were tasked with reviewing more than 40% of cards received from the field. In addition they also conducted home audits to ensure that homes being recorded were actually sprayed and that data are correct. In addition district managers reviewed approximately 20% of cards and also conducted daily home audits. The operations manager, M&E manager, the COP, the technical program manager, and other trained staff all participated in the data verification process by visiting districts during the spray operations to check data at all levels, from the reporting of data from the spray operator to the entry process in the database. This process also included trips to the communities to verify that homes were sprayed and that information collected on cards were correct. Additional audits of the database took place by these personnel to ensure that a sampled selection of the data was appropriately entered and reported to the regional office. Each verified spray card was signed and dated by the responsible personnel.

5.1.5 Mass Inter-District Data Verification

An IRS data quality assessment alerted the team to manipulations in the data in previous years of spraying. To ensure more reliable, accurate, and consistent data, the RTI Ghana team organized mass inter-district data verification for all the nine districts as part of a strengthened M&E process for the 2011 spray round. It started on June 18, 2011, at Bunkpurugu-Yunyoo district, where four districts (Bunkpurugu-Yunyoo, Chereponi, East Mamprusi, and West Mamprusi) exchanged their data for verification and validation. All IRS district staff were involved in this exercise. The verification involved calculating a summary of spray operator entries in the daily spray cards to ensure they were correct and matched the totals on the team leaders' summary cards. Errors identified in computation and the summation of the figures were corrected and signed accordingly. All identified errors were recorded and given to the respective data assistants to initiate the necessary follow-up and correct the errors. The remaining five districts also went through this exercise and verified their data on June 25, 2011. About 90% of all the data were verified during the mass inter-district data verification. All the necessary follow-ups were made to ensure that errors identified on each problem card were rectified.

5.1.6 Manual Computation of IRS Data Indicators and Totals

Random samples of data were taken from each district and subjected to the verification process. District totals were then compared with the grand total generated by the database. Some inconsistencies were detected in information obtained during "mop-up" activities. A mop-up house is a house that was visited during a second visit to complete the structures that, for some reason, could not be sprayed during the first

visit. Because the house information was already in the database the demographic information and sprayed data were updated using the unique household IDs

5.1.7 Verification by Querying Spray Operator Daily Coverage

The information captured in the database was the general information on the daily spray card, which included spraying date, district, subdistrict, zone, community, spray operator's name, spray operator's code, team leader, sachet received, empty sachet returned, and sachets used. The other information included the house ID, eligible structures found, eligible structures sprayed, and their demographic data. Information on each house was entered separately.

The Access database allows queries to be run in order to cross-check the correctness of the data and the data quality. For example, the totals obtained from daily spray cards could be cross-checked with the information entered into the database per community or per spray operator. Wrong summations were corrected, and instances where the spray operator data did not tally with the database query, the figure was checked and appropriately corrected. After all corrections were made, the database was queried again for confirmation of the corrections.

RTI also introduced the "data exchange" method as a way of further eliminating or identifying errors that could have been created by the same district. The data exchange refers to the situation where district staff were tasked to verify and validate data from other districts apart from their own districts. The exercise took place on the June 18 and 25, 2011. Again, at the end of the spray operations, a final data exchange was done at the Tamale office from August 1 to 14, 2011. At the end of this exercise, RTI is confident that more than 90% of all its data has been verified.

5.2 Time of Reporting

The RTI Ghana IRS team revised the time of data reporting for the data assistants. In the previous years (2008 to 2010) data assistants had about two to four hours after daily spray operations to input the district data records and report them to the M&E officer to be compiled into the daily tracker, which was sent to PMI on a weekly basis. In the 2011 spray round, data assistants had 24 hours after spray operations to vet the district data before data were transmitted to the Tamale office. Increasing the turnaround time helped reduce the pressure on data assistants to input data, and in turn, reduced the amount of data errors and incorrect entries.

5.3 Results (Structures and Population)

The 2011 IRS spray operations started simultaneously in all 31 operational sites across the nine districts on May 2, 2011 and ended on July 31, 2011.

At the end of spray operations, data from all nine districts indicated that a total population of 926,699 residents was protected. A total of 354,207 structures were sprayed out of the 383,018 eligible structures found, representing an achievement of 92% coverage (Table 8). Out of the protected population, children under five were 188,696 while pregnant women were 21,774.

Table 8: Summary of 2011 IRS Results

District	No. of Structures Sprayed	No. of Structures Targeted for Spraying	No. of People Residing in Structures Sprayed (Population Protected)	No. of Pregnant Women Residing in Structures Sprayed	No. of Children Under 5 Years Residing in Structures Sprayed
Bunkpurugu-Yunyoo	40,188	41,319	100,188	1,841	17,416
Chereponi	20,041	21,265	55,608	1,252	13,522
East Mamprusi	48,397	52,606	124,750	3,159	25,701
Gushegu	34,248	36,593	91,515	2,593	20,502
Karaga	27,461	29,234	75,900	2,050	18,124
Saboba	21,654	23,630	65,893	1,550	13,757
Savelugu-Nanton	34,387	39,294	91,139	1,864	17,097
Tolon-Kumbungu	73,660	80,865	180,798	4,156	34,051
West Mamprusi	54,171	58,212	140,908	3,309	28,526
Totals	354,207	383,018	926,699	21,774	188,696

Figures 3 and 4, respectively, provide final percentages of eligible structures sprayed in 2011, by district, and the cumulative number of structures sprayed in each week of spray operations. Coverage rates in 2011 decreased to 92% from 2010 where the program achieved a 97% coverage, still achieving above the 90% coverage goal. In Savelugu, coverage was recorded at 88%. Savelugu is the district where the data quality audit uncovered data manipulation. This may explain the drop from 98% coverage in 2010. In addition, Savelugu is a peri-urban district; people are often away from this house creating difficulties in coordinating spraying in these areas.

Figure 3: Coverage Report at the End of 2011 Spray Operations, by District

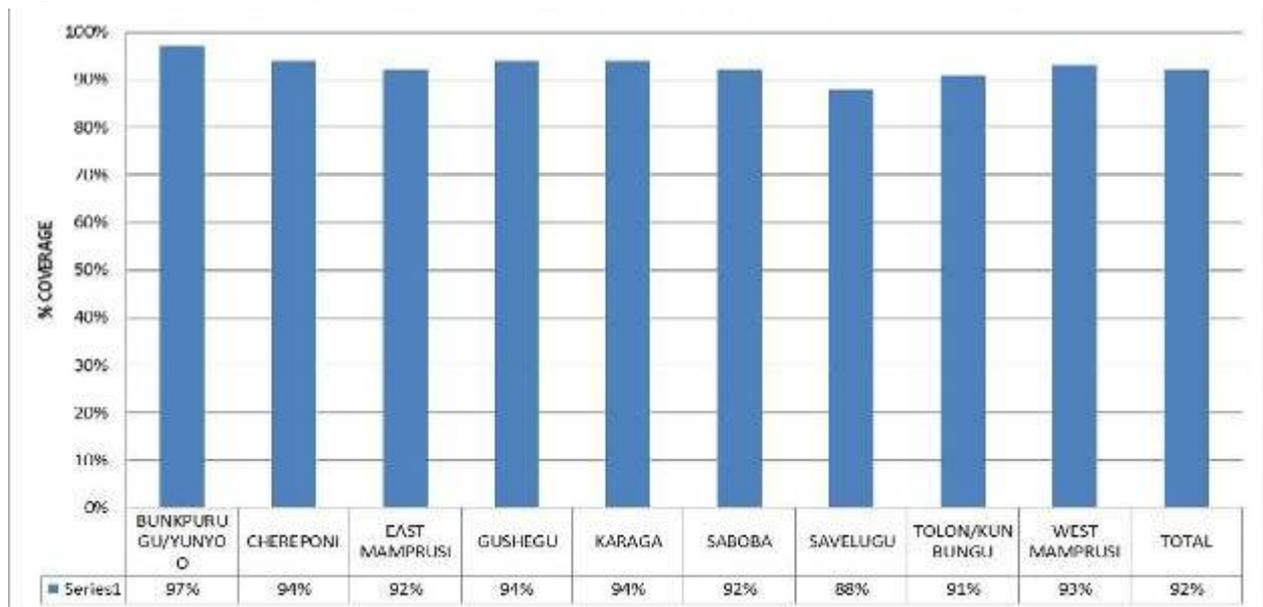
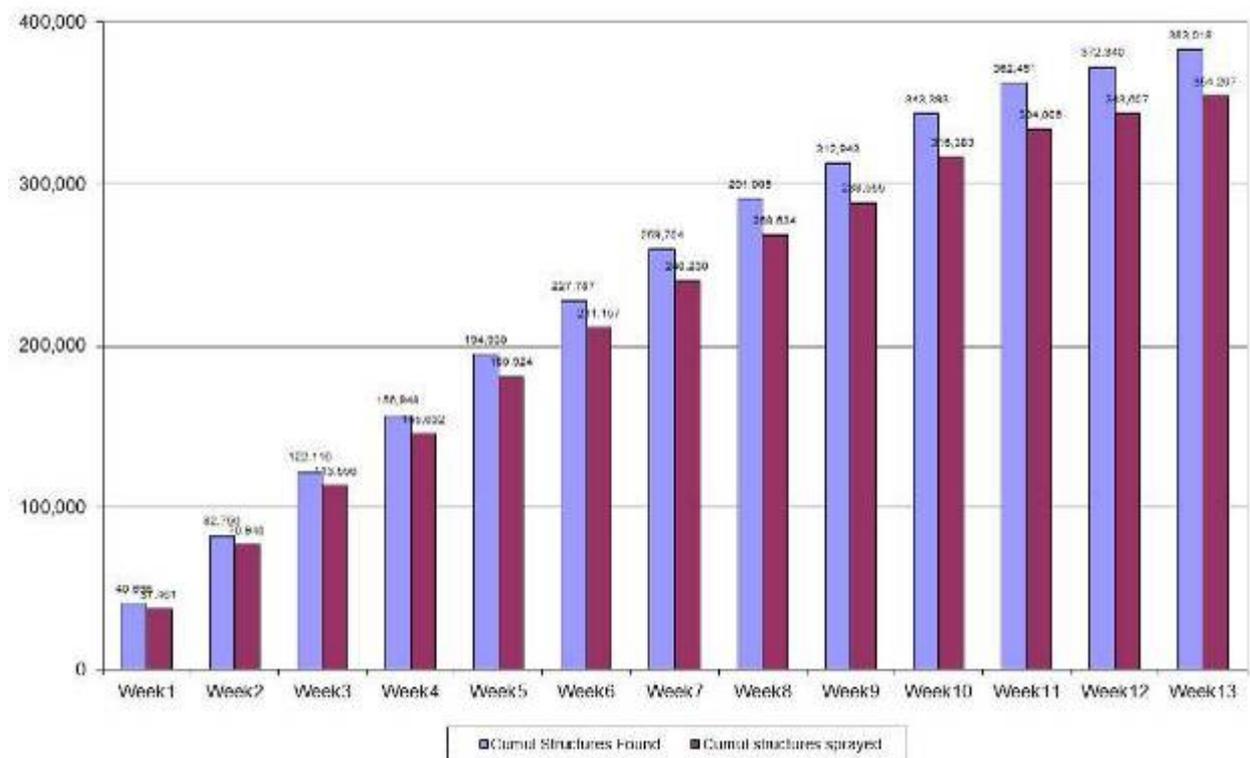


Figure 4: Weekly Coverage Report of Structures Sprayed During 2011 Spraying Activities



6. Implementation of IRS Activities

6.1 Planning, Monitoring, and Supervision

After the deployment of IRS teams to their respective districts, the DOMs and their team members undertook familiarization visits to engage with partners and community leaders and to identify potential operational sites. Logistics and other IRS operational materials were sent to the district level as part of the continuous planning process in preparation for spray activities. Teams also worked to improve conditions within the office space and operational sites.

The Ghana IRS project held a series of micro-planning meetings with relevant stakeholders in all nine targeted districts. These meetings, organized and led in conjunction with the regional health directorate and district assemblies, provided opportunities to discuss with district political leadership, relevant authorities, and opinion and traditional leaders, details of their expected roles and responsibilities in IRS operations. The meetings also furnished the opportunity to update and finalize all operational and logistics assessments for 2011 IRS activities.

The RTI team made geographic reconnaissance visits to the nine IRS beneficiary districts to assess their preparedness for IRS operations for 2011. The visits enabled the RTI team to engage at the local level prior to IRS activities to ascertain the level of infrastructure required for effective, efficient, and environmentally compliant IRS operations and to also initiate discussions about the human resource capital required for IRS operations.

The NMCP and the regional health directorate also conducted field visits to RTI operational sites during the spray operations as part of M&E of program activities. They interacted with the spray operators and the community members and provided valuable information to improve RTI Ghana operations.

The Ghana IRS team worked with the NMCP to facilitate the smooth functioning of the National MaVCOC, which is instrumental for the coordination of IRS operations across Ghana. The oversight committee includes representatives from PMI, NMCP, Global Fund (GF)/AngloGold Ashanti (AGA), RTI, Environmental Protection Agency (EPA), NMIMR, Ministry of Food and Agriculture, Food and Drugs Board, Chirano Malaria project, Zoomlion, and business and industrial entities, among others. The committee, through its task teams on IRS SOPs, insecticide resistance management and training, and capacity building, developed appropriate standards and guidelines for the implementation of IRS operations in Ghana.

As part of efforts to improve financial management systems, the IRS project team instituted a new monthly financial walk-through process to discuss the country expense reports and track expenditures against forecasts. These events, initiated by the project administration specialist, with the participation of the technical program manager, COP, and finance manager, have been implemented throughout the IRS operational period.

The success of the IRS operations during the spray round can be directly linked to the integrated technical support and collaboration among NMCP/GHS, USAID/PMI, CDC, EPA, regional authorities, district authorities, and RTI staff. This collaboration ensured that spray operations were conducted in accordance with prescribed technical SOPs for the application of required dosage of insecticides on the walls, ceilings, eaves and other indoor surfaces suitable for mosquito resting. Monitoring and supervision was done on a daily basis from the community level up to the regional level.

6.2 External Monitoring Visits

During the fourth round of spray operations, several high-profile persons visited IRS operations. The United States Ambassador to Ghana, Mr. Donald Teitelbaum, and the USAID Ghana Mission Director, Ms. Cheryl Anderson, paid a working visit to IRS operations on June 9, 2011. The Ambassador's entourage included the CDC/PMI advisor, malaria program specialist, and staff from the USAID Public Relations Department as well as other GHS counterparts both from the regional and district level. He paid a courtesy visit to a local chief (Nanton Naa), where a colorful *durbar* (ceremonial gathering) was organized in his honor. This visit received both local and national media coverage. The Ambassador interacted with spray operators and observed spray operations in the community, and he also visited houses and interacted with residents who had benefited from the mass ITN campaign organized by another PMI partner (ProMPT project which distributes bednets in Ghana).



The U.S. Ambassador to Ghana interacts with spray operators (left) and meets the Chief Nanton Naa (right)

An audit of PMI Ghana IRS operations took place from May 18 to 20, 2011. A team of two external auditors from the USAID Office of the Inspector General visited IRS operations, observed spray operations in the community, engaged with local partners and stakeholders to assess the level of collaboration, and verified data records. Excerpts from the audit report on IRS operations determined that the program was achieving key results related to preventing and treating malaria by providing IRS to the targeted houses and thereby protected the population by reducing the risk of malaria infection. It found, however, some intentional and unintentional errors with the data entry and reporting. All concerns raised in the audit report have been adequately and appropriately addressed by the Ghana IRS team.

Other visitors to IRS operations included the following:

- USAID Ghana CDC advisor
- CDC entomologist
- NMCP vector control manager
- AngloGold Malaria project staff

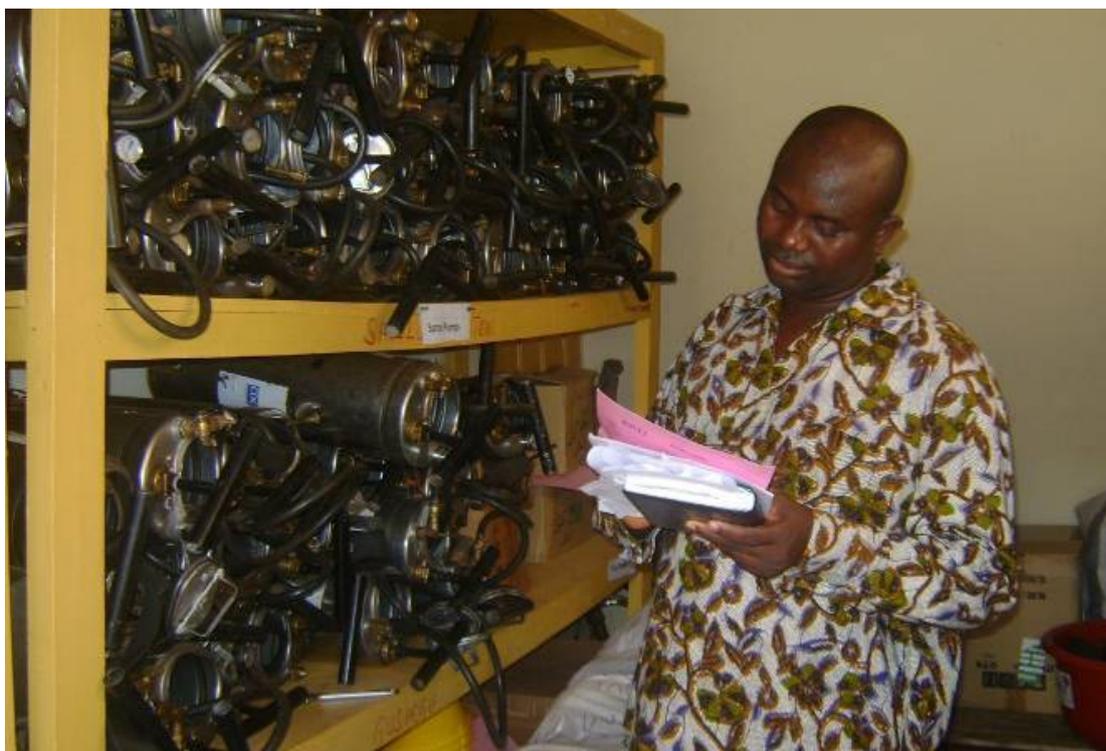
In addition, RTI's regional senior environmental compliance officer and technical program manager conducted technical assistance visits in support of IRS activities in Ghana.

6.3 Logistics Inventory

During this round of spray operations, the logistics manager conducted scheduled inventory inspections of all commodities and reported to the RTI property control officer on a quarterly basis. Two audit teams (from Deloitte and Touche and an independent audit firm) were commissioned by RTI Internal Audit and the Nairobi Regional Office (NRO) to undertake logistics and property inventory control during the year. After the spray round was completed, an inventory assessment of IRS materials (especially of PPE, pumps, and insecticides) took place in all nine IRS districts.



Logistics team in Saboba takes inventory of IRS materials at the end of 2011 spray operations



Independent auditor at the Tamale regional warehouse checking stock cards on spray pumps

A total of 107 vehicles comprising 36 buses, 23 double cabin four-wheel-drive pick-up trucks, 45 motorcycles, and 3 sport utility vehicles were used for the IRS operations.

6.4 Preventing Theft of Insecticides and Other Commodities

To minimize theft and misuse of insecticides and other items, the management team of the Ghana IRS project put in place appropriate measures to control and monitor its stock of supplies. Listed below are some of the measures that were put in place:

- All procured items (spray pumps, PPE, etc.) were recorded using forms, checklists, and log books
- Transfers of supplies to or from stores or warehouses (regional, district, and subdistrict stores) were documented and requisitions approved and supervised by authorized staff only
- Logistics assessment and auditing were carried out on a weekly basis.
- All storage facilities were properly secured and double-padlocked, and security guards were always on duty (24 hours).
- Every sachet of insecticide was coded for easy identification and tracking at both regional and district levels.
- Every sachet opened was indicated on the spray operator's daily spray card and witnessed by a representative of the house in which it was opened.

Table 9 provides a summary of items distributed to the various districts.

Table 9: Matrix of Logistics Inputs for the Ghana IRS Project in 2011

Districts	Spray Pumps	Boots	Coveralls	Hard Hats	Head Gear	Hand Gloves	Face Shields	Neck Covers	Fire Extinguishers	Rinsing Barrels	Nose Masks	Jerry Cans	Insecticide Sachets
Tolon-Kumbungu	74	145	235	98	173	1,080	173	115	5	35	6,800	55	16,669
Savelugu-Nanton	58	87	148	68	70	424	54	55	3	21	3,760	63	9,252
Karaga	40	65	90	59	91	255	70	60	2	20	2,040	20	6,142
Gushegu	45	79	127	51	82	480	52	73	3	21	275	28	6,633
West Mamprusi	80	114	200	79	75	744	75	130	5	35	6,320	54	12,277
East Mamprusi	75	100	171	100	75	360	75	178	3	21	4,292	70	10,581
Chereponi	55	56	111	100	88	480	53	58	2	14	2,880	24	4,415
Saboba	45	65	114	60	60	767	80	127	3	21	310	50	4,755
Bunkpurugu-Yunyoo	60	100	214	80	80	532	80	150	4	28	1,143	40	8,149
Regional		3	6			72			6	6	80		
Total	532	814	1,416	695	794	5,194	712	946	36	222	27,900	404	78,873

6.5 Environmental Compliance

Prior to the start of the fourth round of spray operations, the RTI/Ghana IRS team, led by the operations manager, conducted the pre-spray environmental compliance inspection in conjunction with the Regional Directorate of the EPA. As part of the strengthening of the environmental compliance of structures already in use in Ghana, RTI Ghana took both longtime and newly recruited district operations managers to all the nine districts and all the operational sites to assess the state of infrastructure available in the districts. During the field exercise, RTI Ghana trained all the district operations managers, the RTI M&E officer, and the IEC specialist on the Best Practices Management manual developed by USAID on environmental compliance. The RTI operations manager led and facilitated the training. The pre-spray inspection concentrated on insecticide transport and storage procedures and on construction of soak pits facilities for effluent waste disposal. A key success achieved this year was that the Ghana IRS project was able to conduct independent pre-spray assessments.

In all the activities involving environmental compliance, RTI continued to use IRS SOPs as a guide and reference material in ensuring environmental compliance and also as the basis for all trainings and evaluation of IRS operations.

During the TOT sessions, attention was equally given to all components of environmental compliance. RTI trained a total of 53 staff on firefighting techniques during the orientation on IRS operations. The training was replicated for spray operators at the district level.



Training in progressive rinsing (left) and firefighting (right)

Mid-Spray Inspection

Mr. Autman Tembo, RTI's regional senior environmental compliance officer from the NRO, visited Ghana from May 11 to 20, 2011, on a short-term technical assistance visit to conduct the mid-spray environmental compliance inspection on IRS activities. He worked closely with the Ghana IRS team and EPA officials and conducted field visits to three of the nine districts (Tolon-Kumbungu, Savelugu-Nanton, and West Mamprusi). The visits afforded him the opportunity to interact with the spray operators and stakeholders and to assess the quality of field operations. He was very

satisfied with the level of environmental compliance standards in the country. In his debriefing session, Mr. Tembo commended the Ghana IRS team for its continuous improvements in the quality standards.

Quality Assurance/Control of IRS Insecticides

As required in all IRS operations, quality assurance testing was done on the procured insecticide. A random sample of 10 insecticides from different batches were selected and sent to the regional office for quality assurance testing and analysis. The test results confirmed the potency of the active ingredient in the insecticides.

6.6 Entomological Surveillance

Entomological monitoring in IRS is crucial as it ensures the quality and efficacy of IRS operations and justifies the selection of insecticide and targeted spray areas. To accomplish entomological monitoring goals, RTI enlisted the expertise of the NMIMR to provide oversight and quality assurance for all entomological activities. The entomological monitoring activities in 2011 focused on

- Tracking vector susceptibility to various insecticides
- Identifying malaria vector species
- Understanding the vector density and biting behavior in the area where spraying took place
- Understanding the residual effect of the chosen insecticide on different wall surfaces found in the targeted area
- Determining the infectivity rate of the vector by evaluating the proportion of female anopheles mosquitoes in the targeted area carrying plasmodium sporozoites
- Building human capacity in the area of entomological field monitoring and management of an IRS entomological program.

As part of the entomological monitoring activities, monthly surveys were conducted in rural communities of three of the nine districts sprayed (Savelugu-Nanton, Tolon-Kumbungu, and Bunkpurugu-Yunyoo districts) with one unsprayed district (Tamale) serving as the control. Results from the surveys conducted by RTI/GHS and NMIMR joint teams (July 2009 to April 2010) showed estimated man-biting rates of 12.3, 5.3, and 11.8 bites/man/night for Tolon-Kumbungu, Savelugu-Nanton, and Tamale respectively. The surveys also found significant differences in the biting rates of vectors in Savelugu-Nanton and the control district (Tamale). Malaria transmission was found to be generally low for the IRS study districts, with the sporozoite infectivity rate of vectors in Tolon-Kumbungu and Savelugu-Nanton, both being IRS districts, were 0.62% (4/647) and 0.036% (2/557), respectively, whereas Tamale, recorded 1.6% (15/956). Intensity of malaria transmission, measured by entomological inoculation rate (EIR) for the first year was significantly lower ($P > 0.05$) in the IRS districts than for the control district (27.7 infective bites/man/year for Tolon-Kumbungu; 7.0 for Savelugu-Nanton; and 67.9 for Tamale, the control

district). The results of the entomological study have shown that malaria transmission in the IRS communities was reduced by 74.4% compared with the control district.

As part of the insecticide resistance management plan, an insecticide evaluation study was started in May 2011 in Nanton (IRS beneficiary community in Savelugu-Nanton District) using six different insecticides: lambda-cyhalothrin (CS formulation), alpha-cypermethrin, deltamethrin, two formulations of pirimiphos-methyl, and bendiocarb, all within three WHO-recommended classes of insecticides. The RTI technical team, with supervision and oversight from NMIMR, and in collaboration with PMI/CDC is monitoring the insecticidal activity of the selected insecticides on the different wall surfaces. Results from these evaluations are being collated and are expected to provide the IRS program managers guidance on the most appropriate insecticide for use on walls and to assist in the design of insecticide resistance management strategies.

6.7 Solid waste disposal - Incineration

In 2009, RTI Ghana identified an incineration facility at Kumasi Centre for Collaborative Research (KCCR) that met the approved standards for the disposal of the IRS solid waste generated. In 2011, RTI Ghana visited the facility to ensure that it was still in good condition and the authorities were willing to incinerate the solid waste generated during the 2011 spray operations. Particular attention was paid to the following parameters of the incinerator:

- The recommended combustion temperature of between 1,100°C and 1,300°C.
- An after-burner with a residence time of at least two seconds
- Emission control features, including particulate matter filters

Under the supervision of EPA, solid waste at the end of this round of spray operations from all the nine districts were retrieved from Tamale warehouse and sent to KCCR for incineration. At the close of spray operations in August 2011, RTI had incinerated all IRS solid waste materials (empty sachets, used gloves, used face masks) at the approved facility at KCCR.



The KCCR director and RTI logistics officer dispose of solid waste in the incinerator

7. Challenges

- Poor network coverage in the districts affected communication during operations
- Some IRS cards were missing when the houses spray operators visited
- Operations during the peak of the rainy season are difficult because the community members who are predominantly farmers, leave their houses for their farms; and are unavailable for IRS spray teams
- Some community members are reluctant to move items from rooms for spraying
- Isolated cases of political interference occurred, especially during district recruitment
- Difficulty in setting up the new M&E database in time for the beginning of spraying; a backlog of data was difficult for the data clerks to catch up on daily outputs and report to the office in Tamale.

8. Lessons Learned

- Constant dialogue is the most efficient tool for achieving results
- The involvement of DHMT and district assemblies increased community engagement and contributed to its high rate of acceptance
- Recruiting spray operators from the districts led to the high community acceptance of IRS

- Closer collaboration with the district and regional authorities enhanced acceptance of the IRS project
- From the data quality assessment, the team was able to realize some weaknesses in the data verification process. The team quickly fixed the gaps in the process and was able to strengthen the review process for the 2011 spray round.

9. Recommendations

- Engage and train IEC implementers on the IEC data capture forms *at least one month* in advance of spray operations to ensure proper and quality data records.
- Use special paint or markers should to write serial numbers on walls
- Supply districts with a camera to enhance proper documentation of field work
- Maintain CBS volunteers' support because they were instrumental in the mobilizing their communities before, during, and after spray campaign

Appendix A: Ghana Success Story



SUCCESS STORY

Women Support the Fight Against Malaria in Ghana



Women from Ghana's Bunkpurugu-Yunyoo District are integral members of IRS operations teams.

Photo by Scott Torres, RTI International

Lariba Amadu is 1 of 2 women among the 12 team leaders who oversee indoor residual spraying (IRS) operations in Ghana's Bunkpurugu-Yunyoo District. At 24 years old, this is Lariba's first job since graduating from a local university two years earlier with a degree in science. "This is my very first job, and I really enjoy it, knowing that I'm helping my community," said Lariba.

Lariba's efforts have helped Ghana's IRS Program protect over 926,000 people from malaria in the nine targeted districts in the Northern Region in 2011. Ghana is 1 of 17 countries implementing IRS under the U.S. President's Malaria Initiative (PMI), as part of an overarching strategy to eliminate malaria and reduce malaria-related deaths by 50%. Led by the U.S. Agency for International Development, PMI delivers four highly effective interventions—(1) life-saving antimalarial treatments; (2) insecticide-treated nets; (3) preventive treatment against malaria for pregnant women; and (4) indoor spraying of homes with insecticide, or IRS. These interventions are targeted to Ghana's most vulnerable populations—pregnant women and children under five years of age.

Women have played an important part in Ghana's fight against malaria. They are the primary caretakers of young children in most families and are in the best position to detect malaria symptoms, seek medical attention, and help promote healthy behaviors related to malaria prevention. As leaders of their households, women are often responsible for preparing and responding to IRS spray teams.

In Bunkpurugu-Yunyoo District, women, such as Lariba, are now broadening their roles in eliminating malaria by joining the IRS labor force. Although their participation in IRS operations has been historically low—particularly in culturally conservative communities such as in Ghana's Northern Region—women are applying for positions traditionally held by men, including spray operators, team leaders, and supervisors. Among the 85 workers that make up the Bunkpurugu-Yunyoo District's IRS team, 11 are women. IRS District Manager, Williams Abilla, said, "This was the first year of the IRS program in the Bunkpurugu-Yunyoo District, and there was a misconception in

"...There was a misconception in the community that this work was only for men. We want more women to apply next year."

Telling Our Story
U.S. Agency for International Development
Washington, DC 20523-1000
<http://stories.usaid.gov>



Photo by Scott Torres, RTI International

Spray operators prepare their spray pumps for the next day.

...Recruiting and training women for IRS campaigns also engenders opportunities for women to generate income for their families and build social capital in their communities.

the community that this work was only for men. We want more women to apply next year."

Janet Janglaar, a 26-year old team leader in the Bunkpurugu-Yunyoo District, said, "It was difficult in the beginning and physically demanding, but I quickly learned the job and have really enjoyed the challenge." A 2004 university graduate in business, she noted, "The men have been very easy to work with. They seem to respect and listen to us."

While advancing overall PMI goals, recruiting and training women for IRS campaigns also engenders opportunities for women to generate income for their families and build social capital in their communities. The Bunkpurugu-Yunyoo District IRS team recently hired its first female spray operator, Grace Datika, a 19-year old technical school graduate. "Before this, I didn't have a job and stayed in the house all day," Grace shared, "It's very nice to have my own money." According to Grace, this job has encouraged her to openly communicate with residents in the targeted communities, helping her develop skills for future employment.

In the Bunkpurugu-Yunyoo District, women on the IRS team are outperforming men. "Grace can spray more structures in a day than most men," commented Williams, "Lariba is one of our best team leaders. She goes the extra mile to make sure that her team is successful." After witnessing these women excel in their work, Williams hopes more women will apply next year. All candidates—men and women—must complete a written exam and undergo physical training.

As IRS campaigns proceed in Ghana, PMI will continue promoting women-centered approaches to augment women's involvement in all aspects of malaria control. The Ghana IRS Program will expand its efforts and reach to train and employ qualified women in spray operations by disseminating recruitment announcements and conducting outreach campaigns that clearly inform communities about the opportunities available for women to serve as integral members of IRS operations teams.