



Ghana Spraying Performance Report

Indoor Residual Spraying (IRS 2) Task Order One

Contract GHN-I-01-09-00012-00

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Table of Contents

	Page
List of Figures	iv
List of Tables.....	v
Acknowledgements.....	vi
Abbreviations	vii
1. Executive Summary.....	1
2. Country Background.....	2
2.1 Malaria Transmission and Burden.....	4
2.2 National Malaria Strategy	5
2.3 District Selection.....	5
3. Preparation for IRS.....	7
3.1 Logistics Needs Assessment.....	7
3.2 Selection of Insecticide.....	7
3.3 Human Resource Requirements	8
3.4 Training.....	9
3.4.1 Training of Trainers (TOT) Workshop	9
3.4.2 Training –District Level	10
3.4.3 Other Training.....	11
3.4.4 Entomological Training	11
3.4.5 Training of IEC Implementers.....	12
3.4.6 Poison Management Training.....	13
4. IEC Activities and Community Mobilization.....	13
4.1 Regional Stakeholders Meeting	13
4.2 IEC Activities.....	16
4.3 End-of-spray IEC Activities.....	19
4.3.1 District Level Post-spray Evaluation Meetings	19
4.3.2 Regional Level Post-spray Evaluation Meeting.....	20
5. IRS Results (M&E).....	21
5.1 Environmental Compliance Monitoring.....	21
5.2 Spray Operations.....	21
5.3 Results (Structures and Population).....	21
6. Implementation of IRS Activities.....	24
6.1 Planning, Monitoring, and Supervision.....	24
6.2 External Monitoring Visits	255
6.3 Logistics.....	266
6.4 Environmental Compliance.....	299
6.5 Environmental Monitoring.....	33
6.6 Entomological Surveillance	35
6.7 Closing of IRS Operations	366
7. Challenges	366
8. Lessons Learned	377
9. Recommendations.....	388
9.1 Community Relations	388
9.2 Human and Environmental Safety.....	399
9.3 Spray Operations.....	399

9.4	Institutional Collaboration and Partnerships.....	399
Appendix A.	Ghana Sustainability Chart	40

List of Figures

	Page
Figure 1: Ghana Malaria Transmission Season and Prevalence Model.....	4
Figure 2: Map of Ghana showing Northern Region Districts.....	6
Figure 3: Coverage Report of 2010 Spray Operations.....	23
Figure 4: Weekly Coverage Report of Structures Sprayed in 2010 Spraying Activities	23

List of Tables

	Page
Table 1: District Staff (hired on a temporary basis)	8
Table 2: Spray Operators and Other Auxiliary Staff.....	9
Table 3: Summary of IEC Implementers for IRS Round 3	13
Table 4: Community mobilization for Pre-IRS Operations: Participant Information at Various Stakeholders Meetings.....	14
Table 5: Women’s Groups Targeted and Reached through IEC Mobilization Efforts	17
Table 6: Breakdown of Numbers Reached Through In-School IRS Sensitization	18
Table 7: IEC Materials	19
Table 8: Number of Participants Attending Post-IRS Stakeholders Meetings in Each District.....	20
Table 9: Summary of IRS Results for 2010	262
Table 10: Matrix of Logistics Inputs for Ghana IRS Project Round 3.....	336
Table 11: Round 3 Warehouse Reconciliation Report	27
Table 12: Mitigation Activities for IRS Project.....	33

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Abbreviations

ACTs	artemisinin-based combination therapy
CA-USA	Crown Agents USA, Inc.
CDC	United States Center for Disease Control and Prevention
CHPS	Community Health Planning System
COP	chief of party
COTR	Contracting Officer's Technical Representative
DHMT	District Health Management Team
DHO	District Health Offices
DHT	District Health Team
EPA	Environmental Protection Agency (U.S.)
FAO	Food and Agriculture Organization of the United Nations
FY	Fiscal year
GF	Global Fund
GFATM	Global Fund to Fight AIDS, Tuberculosis, and Malaria
GHS	Ghana Health Service
GILLBT	Ghana Institute for Literacy, Linguistics and Bible Translation
HPN	Health, Population, and Nutrition
IEC	information, education, and communication
IRS	indoor residual spraying
ITN	insecticide-treated net
IVM	Integrated Vector Management
km	kilometer
L	liter
M	meter
M&E	monitoring and evaluation
ml	milliliter
MOE	Ministry of Environment
MOH	Ministry of Health
NGO	nongovernmental organization
NMCP	National Malaria Control Program
NMIMR	Noguchi Memorial Institute for Medical Research, Ghana
PERSUAP	Pesticide Evaluation Report and Safe Use Action Plan
PMI	United States President's Malaria Initiative
PPE	personal protective equipment
SOP	standard operational procedures
STTA	short-term technical assistance
TOT	training of trainers
US	United States
UNICEF	United Nations Children's Fund
USAID	United States Agency for International Development
WG	Wettable granules
WHO	World Health Organization
WHOPES	WHO Pesticide Evaluation Scheme

1. Executive Summary

Ghana is in its third year of indoor residual spraying (IRS) operations since being selected as one of 15 focus countries in sub-Saharan Africa to benefit from a five-year, \$1.2 billion initiative to rapidly scale up malaria prevention and treatment interventions in high-burden countries.

Ghana received funding to implement IRS under the United States President's Malaria Initiative (PMI) in 2007. The United States government is assisting the Ghana Health Service/National Malaria Control Program (NMCP) within the Ministry of Health (MOH) to expand use of IRS to prevent and control malaria. The goal of PMI is to achieve 85% coverage of artemisinin-based combination therapies (ACTs), prevention with insecticide-treated nets (ITNs), intermittent preventive treatment for pregnant women, and IRS to reduce malaria-related mortality by 50%.

PMI is committed to continuing its support of the NMCP in achieving high coverage levels of IRS, to ensure that malaria transmission levels are knocked down and kept down, while simultaneously expanding the capacity of NMCPs to plan, execute, and monitor IRS programs. PMI, in partnership with the National Malaria Control Programs (NMCP) and in support of Ghana's country-level strategic plan, is providing technical, operational, managerial, and commodity support for IRS campaigns in Ghana.

The first round of IRS in 2008 targeted the five districts of Gushegu, Karaga, Savelugu/Nanton, Tolon/Kumbungu, and West Mamprusi. In 2009, PMI expanded IRS operations in Ghana from five to six districts (adding East Mamprusi district), protecting over 708,000 residents. The PMI-supported project is rapidly building national capacity and paving the way for further scale-up of IRS to about 40 of the 160 districts in Ghana under the recently approved Global Fund Round 8 grant. In 2010, PMI supported spraying in these six districts and expanded to include the districts of Chereponi and Saboba, protecting over 800,000 persons.

For the district of Bunkpurugu-Yunyoo, the IRS project is supporting baseline entomological studies (June 2010) and epidemiologic studies in preparation for the commencement of IRS activities in 2011.

The IRS campaign was conducted May 4, 2010–July 31, 2010. Community mobilization and information, education, and communication (IEC) activities commenced one month ahead of spray operations in all eight districts. On May 4, 2010, spray operations started simultaneously in all 27 operational sites across the eight districts. At the end of spray operations, data from all eight districts indicated that a total population of 849,620 was reached, exceeding the anticipated target of approximately 800,000. Out of a total of 352,177 eligible structures found, 342,876 structures were sprayed; thus, representing an achievement of 97% coverage.

Out of the protected population, children under five were 177,943 while pregnant women were 20,014. The Ghana IRS project found a total of 193,949 ITNs, and 16,234 pregnant women and 149,819 children under five had slept under an ITN the

night before spraying was conducted. A total of 72,620 sachets of a pyrethroid insecticide (deltamethrin) were used during this year's spraying activities.

Consistent with RTI Ghana IRS practice, all activities were preceded by several microplanning meetings with relevant stakeholders in all the eight districts for purposes of soliciting inputs into the IRS operational plan. The Regional Health Directorate and District Assemblies played lead roles in organizing and holding these planning meetings. Operational and logistics needs assessments were undertaken to determine the requirements for 2010. RTI conducted geographical reconnaissance visits to the IRS beneficiary districts to assess their preparedness for IRS operations for 2010. Observations and recommendations from such visits were incorporated into the implementation plan.

Throughout the year, several technical and administrative review meetings were organized in Accra and Tamale to fine tune preparations for IRS Round 3 spray operations. The District Health Management Teams (DHMTs) and the district assemblies assisted RTI to secure offices, warehouses, stores, and accommodations for IRS operations in all eight districts. Some of these facilities had to be renovated and refurbished to make them suitable for use.

As part of the district demobilization efforts, all eight IRS districts held their district close-out events to obtain feedback from beneficiaries, stakeholders, and partners on the Round 3 operations. 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 17, 2010, to evaluate the IRS operations and also to receive feedback and recommendations for improving future IRS rounds. Participants were drawn from USAID, PMI, United States Center for Disease Control and Prevention (CDC), NMCP, Noguchi Memorial Institute for Medical Research, Ghana (NMIMR), World Health Organization (WHO), Ghana Health Service (GHS), traditional leaders, the media, representatives of DHMT and district assemblies of beneficiary districts, and RTI staff.

One of the key goals of PMI is to build local capacity to conduct and sustain effective malaria control and integrated vector management activities (Refer to Appendix A – Ghana Sustainability Chart). In this regard, an entomological training workshop was organized by RTI and Noguchi for GHS staff, district assemblies, and RTI district staff from July 25 to August 6, 2010 in Tamale. NMIMR research fellows helped facilitate the training and there were a total of 40 participants.

The major challenges confronting the IRS operations included the poor road network, hard-to-reach communities, early rains, long travelling time and dispersed communities. Others included inadequate district and subdistrict data, political and ethnic sensitivities.

2. Country Background

In September 2009, RTI International was awarded the Indoor Residual Spraying 2 (IRS 2) Task Order One for the continued implementation of IRS through sub-

Saharan Africa. The purpose of this task order is to support PMI, as well as USAID Missions and Bureaus with malaria programs in planning and implementing IRS programs with the overall goal of reducing the burden of malaria in Africa. This task order will enhance USAID's ability to implement IRS projects on the ground through cost-effective commodities procurement and logistics systems, access to technical expertise, and implementation of IRS in countries affected by malaria.

Under a contract with the USAID, RTI is the prime contractor for the implementation of the IRS 2. RTI collaborates with its subcontractors and partners, Crown Agents USA (CA-USA) for procurement and logistics services; the NMCP's task team on communication for information, education, and communication materials; and NMIMR for entomological assessment and surveillance.

As indicated in the Malaria Operational Plan for Ghana, RTI provides strategic, technical, management, and operations support to implement NMCP's and USAID's goal of reducing malaria-associated mortality in selected IRS districts during the third round of spray activities in 2010. Coverage for Round 3 operations was expected to protect a population of about 800,000 with the goal of improving IEC services to increase community acceptance. Early planning and proper organization of work schedules enabled Ghana IRS staff to collaborate with stakeholders and partners, manage resources judiciously, and facilitate all IRS activities smoothly at the district levels for improvement of quality standards.

Specific support for IRS implementation for fiscal year 2010 included:

- Procurement of insecticide and equipment for IRS (competitive tendering process was followed).
- Technical and financial support for IRS operations protecting approximately 800,000 people, including conducting training for about 333 spray operators, 324 IEC implementers, unit committee and assembly members, store keepers, washers, supervisors, operational site managers, and district operations managers.
- Support for environmental assessments and monitoring as per the United States' Code of Federal Regulations 216 and the establishment of capacity for best practices in the target districts for pesticide 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 insecticide resistance evaluation in order to generate critical data on the efficiency and effectiveness of the spraying program and potency of the insecticide to be used for vector control decision making.
- Cooperation with Ghana Health Service (GHS)/NMCP and NMIMR in the effort to capture data (through the anemia and parasitemia prevalence study) on the public health impact of IRS.

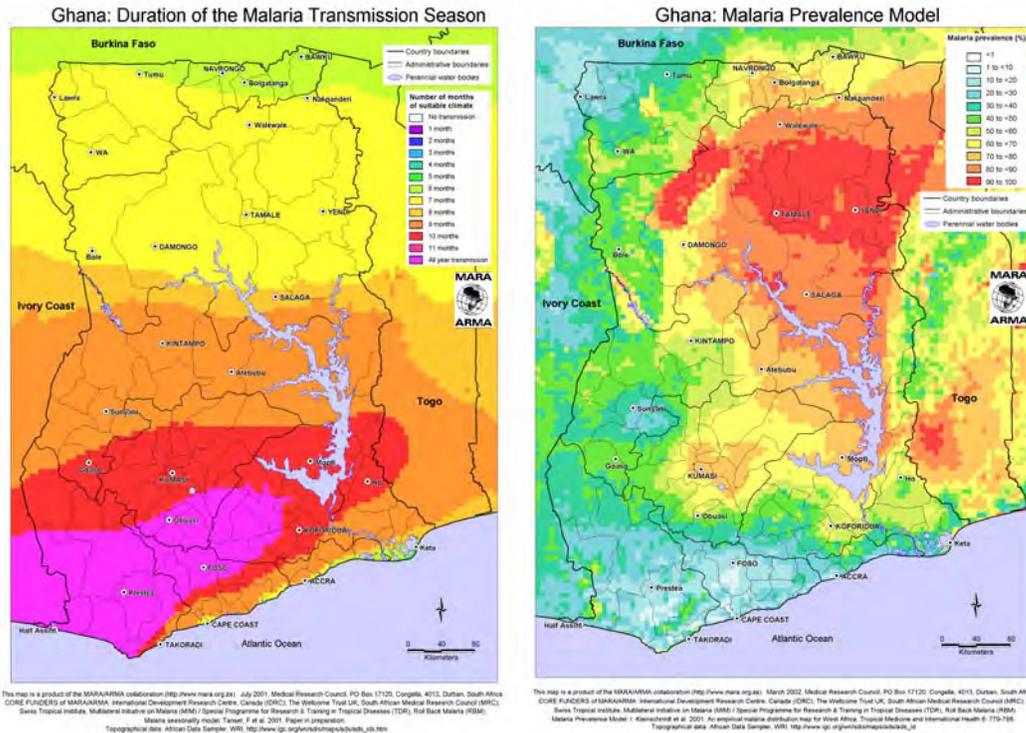
This spraying performance report for Round 3 summarizes the activities, achievements, lessons learned and recommendations to improve future IRS activities.

It also spells out progress that has been made toward achieving PMI's objectives in Ghana.

2.1 Malaria Transmission and Burden

Malaria is hyper-endemic in all parts of the country, with all the 23 million population at risk. Transmission occurs all 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. In Ghana, malaria 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 represent the malaria transmission season (left) and prevalence model in Ghana by region (right).

Figure 1: Ghana Malaria Transmission Season and Prevalence Model



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

Selection Criteria

Based on the above information, the NMCP and PMI justified the rationale for undertaking the IRS operations in the Northern Region of Ghana based on the following factors

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

2.2 National Malaria Strategy

In June 2008, the NMCP led the development of a revised National Strategic Plan for 2008–2015. A new plan was needed to reflect the changing technical and political environments (e.g., the increasing prominence of ACT, IRS, and Ghana’s revised Poverty Reduction Strategy). The National Strategic Plan calls for a reduction in malaria disease burden (morbidity and mortality) of 75% by the year 2015 (using 2006 as the baseline). To achieve this goal, the country has developed a comprehensive and integrated strategy. The primary interventions under this strategy include providing early diagnosis with prompt and effective treatment of malaria using ACTs, scaling up vector control measures with considerable emphasis on universal long-lasting insecticidal net coverage, targeting IRS application in selected areas, and using intermittent preventive treatment in pregnancy.

In 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 available funds. The NMCP supports the use of complementary methods such as larviciding and environmental management. However, in practice, there has been less emphasis on these methods, partly because international donors have not favored them. Mass larviciding or 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 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, and forge functional partnerships and mechanisms between departments and programs within and outside the health sector.

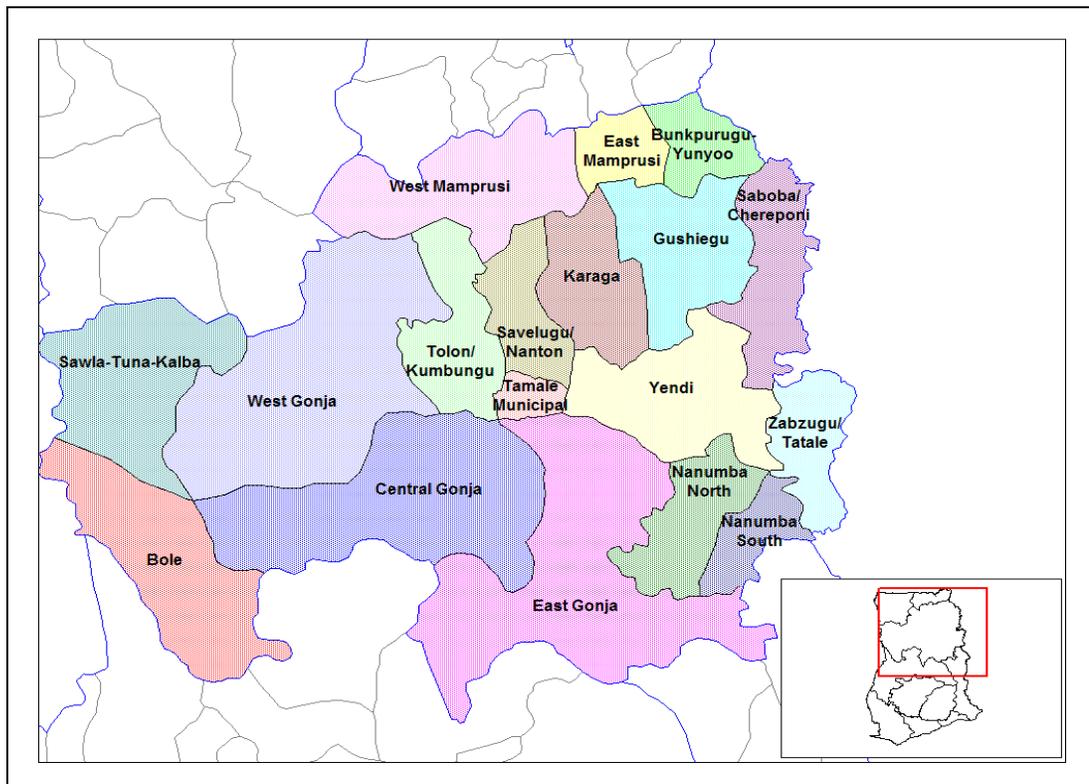
2.3 District Selection

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 include:

- An area where transmission is predominantly seasonal and could be successfully interrupted through minimizing the longevity of the female *Anopheles* mosquitoes (An. Gambiae mosquitoes account for over 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.
- Transmission of *Anopholes* mosquitoes.
- An area with a population that would match the available resources proposed for the IRS activities.

It was against this backdrop that the Northern Region was selected. It had the highest disease burden and, therefore, the highest morbidity and mortality per the 2005 annual malaria report. In addition, the NMCP indicated that the Northern Region is epidemic prone, hard to reach, and characterized by seasonal transmission of malaria. The first IRS round in 2008 covered five districts—Gushiegu, Karaga, Savelugu/Nanton, Tolon/Kumbungu, and West Mamprusi; the second round, in 2009, covered six districts, —addition of East Mamprusi. In 2010, two new districts were added to the six previous districts making eight. Baseline measurements (on entomology and epidemiology) are being done in the ninth district (Bunkpurugu-Yunyoo) this year in anticipation of spraying in 2011. These districts are shown in Figure 2.

Figure 2: Map of Ghana showing Northern Region Districts



Source: http://en.wikipedia.org/wiki/Image:Northern_Ghana_districts.png

Note : Saboba/Chereponi is now two separate districts. An updated map was not available when this report was being written.

3. Preparation for IRS

Though IRS works comprehensively, to maximize operational efficiency, project components are compartmentalized. The major components of these various activities carried out during the 2010 spray round are detailed in the sections below.

3.1 Logistics Needs Assessment

The Ghana IRS team conducted an environmental inspection and subsequently prepared a needs assessment report in May 2010 identifying the following critical issues that needed to be addressed before operations started: inadequate transportation, lack of human resources to support implementation, lack of operational site offices, and storage facilities for insecticides in disrepair. All materials used for Round 2 operations were intact except for soak pits, which needed refurbishment.

The Ghana IRS team implemented all of the recommendations of the report, including rehabilitating soak pits, reinforcing doors and locks, and constructing temporary washrooms at all operational sites. To address the human resource concerns, 9 logistic assistants, 18 store assistants, and 52 security guards were hired and trained in all the IRS districts. Their main duty was to ensure the security and efficiency in the use of RTI-procured equipment and commodities at their respective levels.

A competitive bidding process, published in newspapers, was conducted to acquire vehicles for use during the spray operations to transport spray operators and coordinate and supervise activities. Fifty one vehicles, out of about eighty inspected, were finally selected and rented: 32 Benz buses with a capacity of 23 people each and 39 motorcycles were divided among the eight districts; and 19 4x4 pickup trucks were used for coordination and supervision activities at the district level and from the Tamale office.

3.2 Selection of Insecticide

From July to December 2009, NMIMR conducted a monthly entomological assessment and subsequently prepared and submitted a preliminary report to the NMCP in January 2010, which recommended that the pyrethroid class of insecticide would be the most effective and appropriate for use. The insecticide selection took place between February and March 2010. After reviewing and evaluating the report's recommendations, the NMCP issued a letter endorsing pyrethroids as the insecticide class of choice. RTI and its procurement partner, Crown Agents USA, developed an insecticide solicitation specifying insecticide class and other specifications. Through the procurement processes, deltamethrin 25% wettable granule [WG] was finally selected as the insecticide.

In addition to its wide availability and ease of local procurement, the choice was also informed by the following:

- The wall surface, the durability, and the effectiveness of the insecticide.
- Deltamethrin 25% WG belongs to the group of pyrethroids and has been registered in Ghana as an approved insecticide.
- Acceptance by the NMCP and national regulatory authorities.
- Approval by the WHO and satisfied safety standard described in USAID Environmental Assessment on Integrated Vector Management.
- Deltamethrin is biodegradable and poses no risk to the environment and livestock.

- The malaria vector susceptibility to the chemical (no resistance).
- The chemical lasts four to six months after spraying and is cost effective.

3.3 Human Resource Requirements

IRS operations require a large staff and is very labor intensive. A careful and rigorous competitive selection process was used to recruit staff for all levels of operations. The objective was to ensure that well-qualified highly competent candidates were given the opportunity to work on the IRS project in Ghana. All district staff were recruited by the RTI Ghana office with representatives from EPA, GHS, and WHO forming a part of the panel of interviewers. Spray operators and other auxiliary staff were recruited by the district assemblies and the DHMTs, based on an acceptable criteria agreed upon by all partners. RTI maintained the responsibility of training, supervision, and remuneration of all staff.

The RTI Ghana office in Tamale has a full-time staff consisting of the chief of party (COP), finance manager, logistics officer, IEC officer, M&E/environmental officer, data manager, office manager, entomologist, administrative assistant, and three drivers.

A total of 333 spray operators were recruited and trained. In addition to spray operators, 82 team leaders, 27 supervisors, 26 site managers, 53 washers, and 49 water suppliers among others were recruited for IRS operations. Spray operators were supported by the program management team made up of team leaders, supervisors, site managers and RTI district staff. The COP and his team coordinate all district activities in terms of collating daily performance and transmission of data to RTI's partners. Tables 1 and 2 summarize the human resource outlay for IRS Round 3 operations.

Table 1: District Staff (hired on a temporary basis)

Staff	SND	TKD	GUD	KAD	WMD	EMD	SBD	CPD	TOTAL
District operations managers	1	1	1	1	1	1	1	1	8
M&E coordinators	1	1	1	1	2	1	1	1	9
Data managers	1	1	1	1	1	1	1	1	8
Logistics assistants	1	1	1	1	1	1	1	1	8
IEC assistants	1	1	1	1	2	1	1	1	9
Finance assistants	1	1	1	1	1	1	1	1	8
Total	6	6	6	6	8	6	6	6	50

District abbreviations (left to right): SND - Savelugu/Nanton; TKD - Tolon/Kumbungu; GUD - Gushegu; KAD - Karaga; WMD - West Mamprusi; EMD - East Mamprusi; SBD - Saboba; and CPD - Chereponi.

Table 2: Spray Operators and Other Auxiliary Staff

Staff	SND	TKD	GUD	KAD	WMD	EMD	SBD	CPD	TOTAL
Spray operators	44	64	36	25	56	48	30	30	333
Team Leaders	11	16	9	6	14	12	7	7	82
Supervisors	4	5	3	2	5	3	3	2	27
Security guards	6	10	6	4	10	6	6	4	52
Washers	6	10	6	4	11	6	6	4	53
Water suppliers	3	20	3	2	10	6	3	2	49
IEC implementers	35	45	45	35	50	40	38	36	324
Store assistants	2	4	2	1	4	2	2	1	18
Pump mechanic	3	5	3	2	5	3	3	2	26
Site managers	3	5	3	2	5	3	3	2	26
Drivers	7	7	6	4	8	7	5	4	48
Total	124	191	122	87	178	136	106	94	1,038

3.4 Training

3.4.1 Training of Trainers (TOT) Workshop

RTI relies on a well-trained corps of staff to implement IRS in the beneficiary districts. This requires familiarizing trainees with the underlying principles of IRS in the control of malaria. To this end, the RTI team held a TOT workshop in Tamale on April 11–16, 2010. The training, led by RTI’s M&E/Environmental Officer and COP, was conducted in two parts: a theoretical classroom style lecture/discussion and a practicum featuring hands-on use of insecticide application techniques according to the *IRS Training Guide for Spray Operators*.¹ Other facilitators were drawn from GHS, NMCP, NMIMR, and EPA.

The following topics were covered:

- Overview of the PMI and IRS
- Malaria burden, epidemiology, and control policies and strategies
- Choice of insecticides
- Safe use of insecticides
- Personnel protection

¹ USAID (2009). *IRS Training Guide for Spray Operations*. Research Triangle Park, NC: RTI International, Indoor Residual Spraying (IRS) for Malaria Control Indefinite Quantity Contract (IQC), Task Order 1, IQC GHN-I-01-06-00002-00. Available at http://www.fightingmalaria.gov/technical/irs/irs_training.pdf

- Data collection tools in IRS
- Environmental compliance
- Quality assurance
- Spray practice sessions
- Community entry strategies
- Teamwork
- Practicum

In total, 41 participants attended and successfully completed the TOT, including 10 participants from ZoomLion Ghana Limited, a local private organization targeting environmental sanitation. The participation of ZoomLion in the TOT was an excellent opportunity for the IRS/Ghana project to build the capacity of private organizations in the community who are interested in IRS as a method for controlling malaria in the local communities.

3.4.2 Training –District Level

With the completion of the TOT workshop, the trainers then facilitated the training of spray operators and other staff at the district level as part of a cascade training strategy. Across all IRS districts, training took place from April 18 to 24, 2010. The facilitators at the district level spray operators training were the RTI district operation managers and M&E officers with support from their respective district disease control officers, the district environmental health officers, and RTI technical staff who had participated in the TOT.

At this level, trainees are expected to have demonstrated literacy and numeracy skills such as filling out the relevant data card correctly. All hired staff are residents of the districts and had good reputations in their respective communities.

The district level training covered the following topics:

- Malaria prevention interventions with a focus on IRS.
- Spraying techniques including swath width, rhythm, swath overlaps timing, and distance maintenance.
- Environmental and personal safety including first aid.
- Pump maintenance and assembling.
- Protection of the environment through progressive rinsing, soak pits, pit latrines, and showers.
- Collection, analysis, and transmission of data.

Through a collaborative effort by RTI and partners at this level, these training sessions were successful.



Trainees participating in training exercises in Karaga, April 2010.

3.4.3 Other Training

Training of Drivers

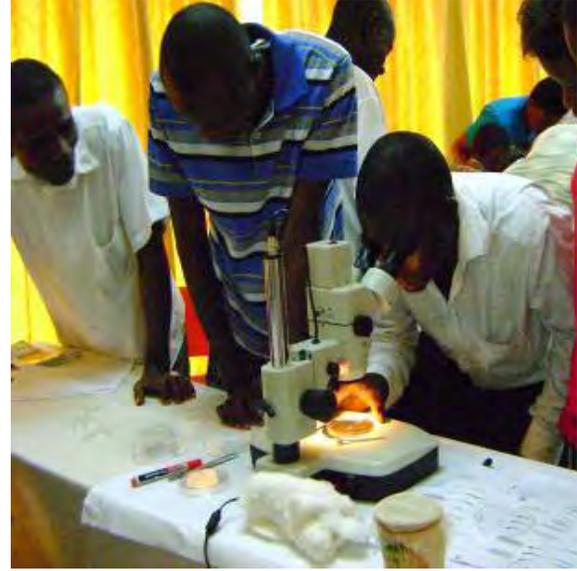
Training of drivers and inspection of vehicles for IRS operations took place April 16–17, 2010, at the RTI office in Tamale. Drivers were trained on defensive driving, reporting procedures, and remedial actions to secure insecticide in case of spillage or accident. Modalities were established with relevant district authorities to facilitate any unlikely event of spillage.

3.4.4 Entomological Training

Continuous capacity development across the project and at all levels remains a priority for the Ghana IRS project. As part of the capacity building efforts, an entomological training workshop was organized for 40 participants from July 25 – August 6, 2010 and was facilitated by staff from NMIMR. The participants came from the beneficiary districts comprising disease control officers, the DEHOs, RTI operation managers, and M&E coordinators.



Field training for mosquito larval collection, August 2010.



Training on morphological identification, August 2010.

3.4.5 Training of IEC Implementers

A large part of the success of IRS is directly related to the promotion of IRS activities through the dissemination of appropriate information and education through an effective communication strategy. In total, 324 IEC implementers were recruited this year, trained, and deployed in collaboration with the DHMT and the district assemblies to work in the eight beneficiary districts. The IEC implementers were placed in zones that they were already familiar with to maximize effectiveness, efficiency, and reach. The IEC implementers worked from April 2010 to the end of July 2010. The IEC implementers exited the program when spray activities were completed in their individual zones. Table 3 represents a breakdown of IEC implementers recruited and trained for the third round of IRS operations in all eight districts.

Table 3: Summary of IEC Implementers for IRS Round 3

No.	District	No. of IEC Implementers
1	Karaga	35
2	Tolon/Kumbungu	45
3	Gushegu	45
4	Savelugu/Nanton	35
5	West Mamprusi	50
6	East Mamprusi	40
7	Saboba	38
8	Chereponi	36
	Total	324

3.4.6 Poison Management Training

To help mitigate any effects of exposure to deltamethrin as a result of the spraying, RTI Ghana organized a poison management training workshop on April 28–29, 2010 for selected health providers of the GHS in the eight PMI supported IRS districts to build on previous training programs from earlier rounds of IRS that were developed by the IRS/Ghana team. Dr. David Kolbilah, medical superintendent at the Tamale Teaching Hospital, facilitated the workshop. This was intended to ensure that medical professionals could respond to and treat victims of accidental exposures and poisoning in the course of IRS operations. A total of 63 health professionals were trained from the various health post and Community Health Planning System (CHPS) compounds in all the IRS districts. Out of the total number trained, there were 37 males and 26 females.

4. IEC Activities and Community Mobilization

To facilitate community mobilization and launch startup of IEC activities, the IEC manager and the district operation managers visited all the IRS districts. Similar activities were held at the regional, district, and subdistrict levels.

4.1 Regional Stakeholders Meeting

A regional stakeholders meeting was held in Tamale on April 28, 2010, prior to the beginning of the spray operations to deliberate on malaria issues in the region and share IRS experiences from the previous years as well as officially launch the third round of IRS operations in the region. The meeting included approximately 42 key stakeholders and partners in attendance. Major participants included the PMI Advisor for the United States Center for Disease Control and Prevention (CDC); the Northern

Regional Malaria Focal Person; staff from the Northern Regional office of the EPA led by the regional director, representatives from NMCP; RTI/Ghana IRS staff; and district directors of health services, district coordinating directors, district disease control officers and district environmental health officers from the eight beneficiary districts.

Community stakeholder meetings were also held in 35 subdistricts across the beneficiary districts from March to July 2010. These meetings were aimed to sensitize community leaders and members about IRS; seek their participation and collaboration; and inform them of their expected roles before, during, and after the spray activities. Participants of these meetings included chiefs, assembly members, Unit Committee members, leaders of women's organizations, religious leaders, health workers, environmental health officers, heads of departments, and other opinion leaders. Responses in all the meetings were positive and encouraging. Table 4 provides the breakdown of stakeholder meetings held and the number of participants during the third round of IRS operations in the eight beneficiary districts.

Table 4: Community mobilization for Pre-IRS Operations: Participant Information at Various Stakeholders Meetings

District	Subdistrict	No. of Participants		
		Male	Female	Total
Karaga	Sandua	85	15	100
	Zandua	90	10	100
	Karaga	62	25	87
	Pishigu	68	12	80
	Total	318	62	367
Tolon/Kumbungu	Tolon	78	12	90
	Dalun	80	13	93
	Kumbungu	80	17	97
	Nyankpala	70	12	82
	Wantugu	57	15	72
	Kpendua	54	16	70
	Total	419	85	504

District	Subdistrict	No. of Participants		
		Male	Female	Total
Gushegu	Gushegu	56	42	98
	Nabuli	35	12	47
	Katani	17	13	30
	Kpatinga	73	29	102
	Galwei	102	42	144
	Zinindow	86	25	111
	Total	369	163	532
Savelugu/Nanton	Pong-Tamale	24	13	37
	Savelugu	70	13	83
	Diare	40	6	46
	Nanton	48	11	59
	Total	182	43	225
West Mamprusi	Walewale	84	23	107
	Kpasenkpe	32	10	42
	Janga	29	8	37
	Yizesi	12	5	17
	Kubori	19	8	27
	Total	176	54	230
East Mamprusi	Langbinsi	43	20	63
	Sakogu	38	24	62
	Gambaga	47	23	70
	Nalerigu	40	27	67
	Gbintri	42	12	54
	Total	210	106	316
Saboba	Saboba	51	5	56
	Wapuli	78	18	96
	Sambuli	84	14	98
	Total	213	37	250

District	Subdistrict	No. of Participants		
		Male	Female	Total
Chereponi	Chereponi	65	17	82
	Wenchiki	90	15	105
	Total	155	32	187
Grand Total		2,042	582	2,611

The IEC materials from previous spray rounds were reviewed and updated to support IRS operations during this spray round:

- Posters (3)
 - 1) Welcome the Sprayer - This picture shows a spray operator dressed in personal protective equipment (PPE) arriving at a home and being welcomed by the family head. It appeals to community members to accept IRS.
 - 2) IRS Steps - This outlines the various steps that that must be followed – before, during and after spraying.
 - 3) IRS Keeps Your Home Malaria Free - This shows a spray operator spraying the inner walls of a house.
- Brochures - This is informational brochure explaining IRS and the role household members play to stay malaria free.
- IEC Stickers - This is pasted on the wall to indicate that a house has received IRS messages from an IEC implementer.
- Spray Operator Stickers - This is pasted on the wall to indicate that a house has received IRS treatment.

4.2 IEC Activities

One of the core components of the IRS program is information, education and communication (IEC), which informs and educates the beneficiary communities about the IRS program. The IEC program is used in IRS to sensitize the communities and to sustain the level of awareness in malaria and IRS to promote the continued willingness of the community to take part in the spraying of houses, building on the success of the previous years. RTI and the NMCP work together to coordinate efforts in community mobilization and the management of education and training programs for the promotion of spraying activities. The IEC team used several methods to reach their intended audience. Some of these approaches focused on targeting women-only group sensitization, in-school programs, focus group discussions, radio programs, and house-to-house visits. Specific IEC details of supplies purchased under the IRS project this year are included in Table 7.

Women-Only Group Sensitization

The IEC team reached out to 46 women's groups consisting of 2,578 women. The Ghana IRS team made arrangements with health officers in charge of pre- and post-natal clinics and slots allotted for certain days of the week for the women to receive IRS information. The content of the information centered on malaria, its prevention strategies, especially in pregnancy and among children under age 5 and on the IRS operations. Table 5 presents a breakdown of women-only group sensitization carried out in the IRS operational districts.

Table 5: Women's Groups Targeted and Reached through IEC Mobilization Efforts

District	No. of Groups	No. of Participants
Karaga	2	326
Gushegu	5	233
Savelugu/Nanton	5	333
Tolon/Kumbungu	3	175
West Mamprusi	17	778
East Mamprusi	5	265
Saboba	2	245
Chereponi	7	223
Total	46	2,578

Community Focus Group Discussions

Community focus group discussions were also used to disseminate IRS information. The IEC team engaged community members in discussions regarding the IRS project. Faith-based groups and various artisanal groups were targeted with IEC messages. The group members were sensitized on malaria, its prevention strategies, and on IRS operations. During the discussions, participants asked questions and made suggestions to improve outreach activities. The discussions throughout the period were very fruitful. It showed the commitment and interest of community members towards the program and the high level of cooperation enjoyed by the program.

In-School IRS Sensitization

Educational institutions were targeted as recipients of sensitization campaigns. In-school IRS sensitization took place in 69 schools covering a population of 18,047 within the eight beneficiary districts (Table 6). For each school, IEC implementers presented information on malaria, its prevention methods, and on IRS operations; they also gave students IRS brochures and posters to provide them more insight on the program and to equip them with the information on IRS to share with their peers and

members of their communities. Responses from the students were very positive and they were also appreciative of the program.

Table 6: Breakdown of Numbers Reached Through In-School IRS Sensitization

District	No. of Schools	No. of students
Karaga	4	1,922
Gushegu	4	408
Savelugu/Nanton	18	7,132
Tolon/Kumbungu	8	1,350
West Mamprusi	9	2,656
East Mamprusi	7	2,355
Saboba	9	963
Chereponi	10	1,261
Total	69	18,047

Radio Program

The Ghana IRS project used local FM radio stations to sensitize communities by carrying IRS messages to listeners that fall under their operating coverage radius. A total of 12 live radio discussion sessions and 42 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 make contributions about the IRS program. The IEC manager and district operations managers served as the resource persons. Some of the callers phoned in from various communities, including non-beneficiary districts to ask questions and all were answered accordingly.

House-to-house Sensitization

Before spray operators sprayed houses in a particular community, the IEC implementers would have informed the families about the spray date and time for actual spraying and explained to them their expected roles before, during and after the spraying. The IEC implementers conducted house-to-house sensitization across all the eight districts from May 2010 to July 2010. Community members were informed of the spray schedule and the do's and don'ts of the exercise, after which IEC stickers were placed on the walls to signify that IRS messages had been given to the members of that house. Information was then passed on to the spray operators about the communities that had received IRS messages and were ready for the spraying to take place.

Evening 'Rendezvous' Sensitization

Another strategy adopted by RTI Ghana during the third round of operations in 2010 was the evening rendezvous sensitization. This refers to the strategy where the district RTI staff targeted young men and women with IRS information in places where they usually met to socialize after work. This strategy helped to reach large numbers of young people.

Table 7: IEC Materials

Item	No. Distributed
Posters	60,000
Brochures	12,000
IEC Stickers	80,000
Polo shirts	1,200
T-shirts	1,200
Baseball caps	1,200

4.3 End-of-spray IEC Activities

4.3.1 District Level Post-spray Evaluation Meetings

In all eight beneficiary districts, RTI Ghana coordinated post-spray evaluation meetings to provide all district-level stakeholders and partners the opportunity to present their observations and suggestions about the third round of IRS operations in their communities. Stakeholders included chiefs and elders, DHMT members, district assemblies, departmental heads, women's groups, spray operators, RTI staff, and a cross-section of the principal beneficiaries. Table 8 shows the number of participants (disaggregated by gender) who attended the stakeholders meetings in each district.

Table 8: Number of Participants Attending Post-IRS Stakeholders Meetings in Each District

District	No. of Participants		
	Male	Female	Total
Karaga	85	15	100
Gushegu	52	10	62
Savelugu/Nanton	62	11	73
Tolon/Kumbungu	85	20	105
West Mamprusi	61	14	75
East Mamprusi	51	26	77
Saboba	55	10	65
Chereponi	50	20	70
Total	501	126	627

These meetings also served as channels for RTI to show its appreciation and to acknowledge community members' support, especially the opinion leaders and chiefs who demonstrated their commitment and continued support for IRS activities.

4.3.2 Regional Level Post-spray Evaluation Meeting

RTI Ghana has implemented mechanisms to review its performance after every round of spraying. One such mechanism is the multisectoral post-spray evaluation meeting which provides the project recommendations and feedback to improve activities in subsequent activities. This year's meeting was held in Tamale on August 17, 2010, to solicit feedback and suggestions on the Round 3 spray operations from stakeholders and partners. It served as a channel for the decision makers at the IRS district and regional levels to provide their inputs. Among the participants at the stakeholder meeting were staff from the NMCP, Northern Regional Health Directorate, WHO, NMIMR, EPA, traditional rulers, community volunteers, and beneficiaries.

The recommendations made in this spraying performance report are based on RTI's IRS experience from the 2010 round of IRS operations in Ghana and the contributions of partners and stakeholders. The lessons learned and recommendations for future IRS operations are presented in the following thematic areas.

- Community relations
- Human and environmental safety
- Spray operations

- Institutional collaboration and partnerships

5. IRS Results (M&E)

The Ghana IRS team planned, implemented, and documented an M&E component that supported the effectiveness of the IRS operations. The Ghana IRS team integrated monitoring activities in every part of IRS operations, which was very useful as it helped correct actions through planning and adapting protocols to enhance the performance.

The Ghana IRS team, together with all its major stakeholders, including PMI in-country team, MOH, NMCP, and EPA, reviewed indicators, methods, and data sources for monitoring and evaluation of IRS operations.

The M&E activities carried out within the period included the key components described below.

5.1 Environmental Compliance Monitoring

An environmental officer from the Nairobi Regional Office Dr. Gaspard Bikwemu visited Ghana and assessed IRS environmental compliance issues. He evaluated the Ghana IRS project based on an IRS environmental compliance checklist. Areas for assessment included warehouses, soak pits, use of PPE, triple rinse system, transportation, and disposal of IRS waste.

5.2 Spray Operations

Spray operations were monitored and evaluated by the Ghana IRS program and NMIMR monitoring teams through the IRS core and non-core indicators to measure effectiveness and efficiency of the IRS spray program. The IRS coverage indicators were measured using the household level data collected on the spray forms by the spray operators. Data fields included structures found, structures sprayed, structures not sprayed (and reason), number of people in household, number of pregnant women, number of children under 5, and number of nets being used. Data cards were compiled, and the totals were analyzed at the district level and reported to the regional office for further analysis.

The capacity building indicator was measured by the number of personnel trained on IRS during the spray round. These evaluation methods demonstrated adherence to WHO technical quality standards for training and supervision, IRS implementation, and environmental compliance.

5.3 Results (Structures and Population)

IRS activities took place in eight districts in 2010: six previously sprayed and two new districts of Chereponi and Saboba. Total coverage at the end of spray operations was 97%, which comprised 342,876 sprayed structures out of a total of 352,177 structures and resulted in 849,620 people protected. This also included 177,943

children under five protected, 20,014 pregnant women protected. As can be observed the target of 800,000 was exceeded by nearly 50,000 people.

Team leaders and supervisors cross-checked spray forms used for the collection of household level data by the spray operators. After they had been reviewed by the district data manager for completeness and accuracy, the data were transmitted to the Tamale office for compilation into a comprehensive data set. Table 9 presents critical evaluation indicators for each district.

Table 9: Summary of IRS Results for 2010

District	No. of Structures Sprayed	No. of Structures Found	No. of People Residing in Structures Sprayed (Population Protected)	No. of Pregnant Women Residing in Sprayed Structures	No. of Children <5 Residing in Sprayed Structures
Chereponi	18,235	18,467	52,586	1,235	12,858
East Mamprusi	51,007	53,462	128,438	2,935	26,569
Gushegu	33,148	35,234	88,867	2,486	21,947
Karaga	29,387	29,785	77,751	2,134	17,940
Saboba	23,473	23,794	65,225	1,465	13,479
Savelugu Nanton	43,515	44,477	106,909	2,140	21,218
Tolon Kumbungu	89,535	91,334	189,152	4,361	35,245
West Mamprusi	54,576	55,624	140,692	3,258	28,687
Total	342,876	352,177	849,620	20,014	177,943

Figure 3: Coverage Report at the End of 2010 Spray Operations

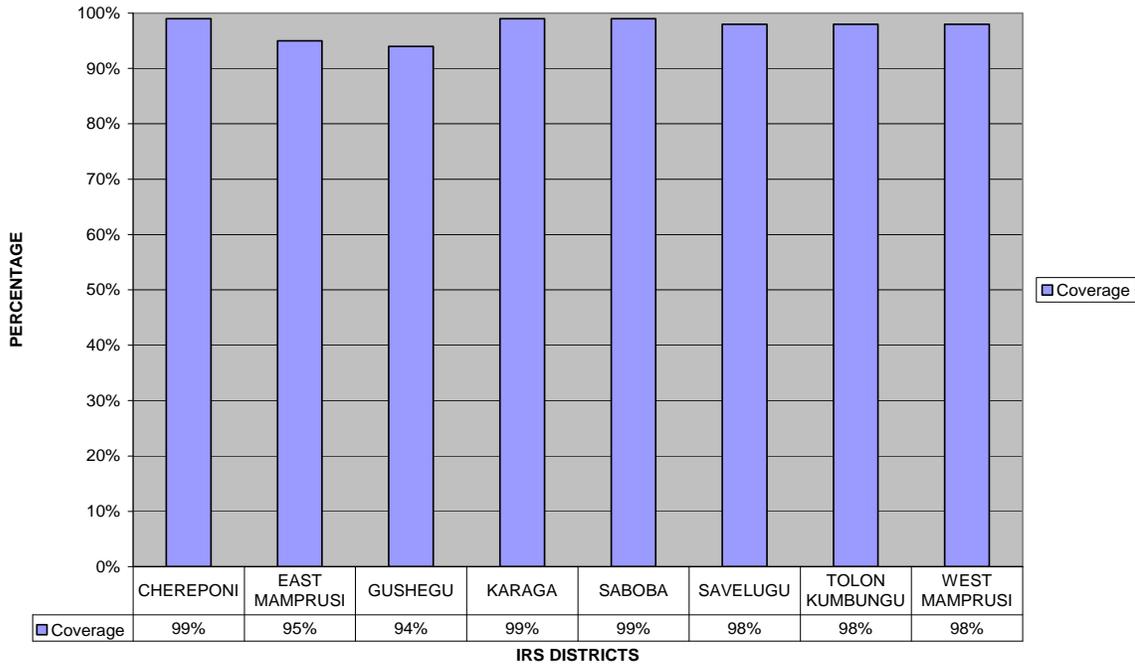
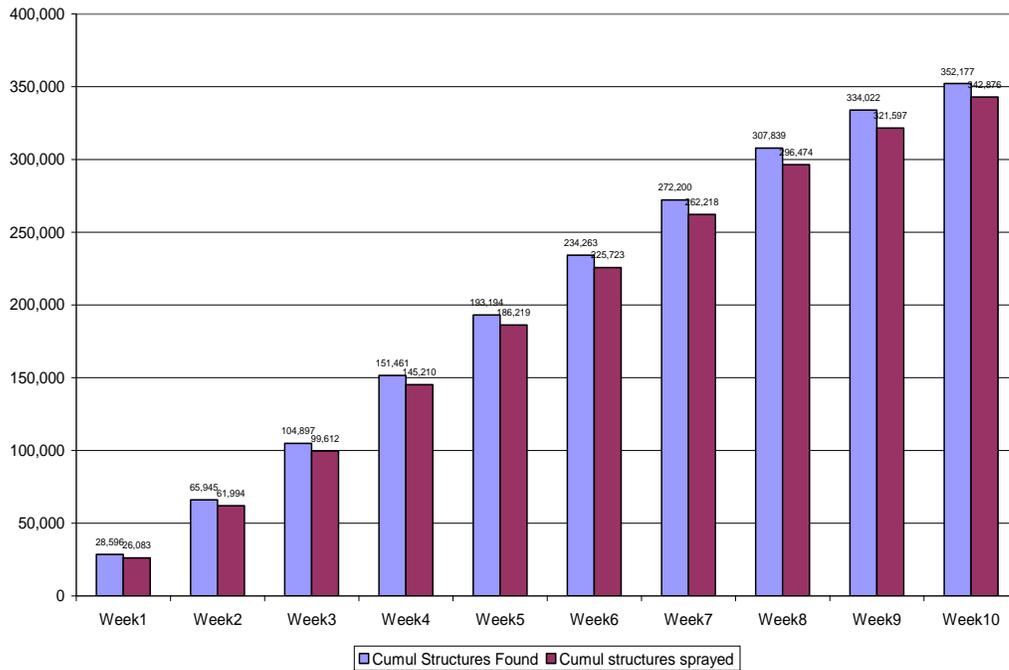


Figure 4: Weekly Coverage Report of Structures Sprayed During 2010 Spraying Activities



6. Implementation of IRS Activities

6.1 Planning, Monitoring, and Supervision

The success of the IRS operations achieved during this third round of IRS 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 ensured that spray operations were conducted in accordance with prescribed technical standard operation procedures for required dosage of insecticides on the walls, ceilings, eaves and other indoor surfaces suitable for mosquito resting. Monitoring and supervision was done on daily basis from the communal level up to the regional level.

Immediate and corrective measures for identified spray operators' errors were taken to improve performance and quality of the spray operations. The Ghana IRS team conducted daily inspections on standard operating procedures for IRS operations with spray operators to receive immediate and regular feedback from the operators and also give directives to accurately address and improve the quality of activities during the spray campaign. On-the-spot training and support visits from the RTI IRS technical team helped identify some problems and remedy them immediately.

To track the output and performance of every spray operator, team leader, and supervisor, the daily data sheets (daily spray cards, team leaders' and supervisors' cards) were used. This recorded the number of structures sprayed per sachet of insecticide used. Through this protocol, the monitoring teams were able to detect operational problems and recommendations put in place immediately to support the spray operations and to improve the quality of data on the IRS project.

Spray teams that had completed activities earlier were mobilized to assist other teams in different subdistricts. This supplemental assistance speeded up the IRS operations and allowed work to be completed on schedule and avoid the peak of the rainy season.

During and after monitoring, team leaders and supervisors were notified of the problems identified and the suggested recommended actions to ensure that these mistakes were corrected. Key issues of focus during routine monitoring and supervision included the following:

- Observing the spray operator when mixing the insecticide with water to ensure adherence to guidelines.
- Observing the spraying techniques of the spray operator and checking the insecticide spray pattern on the sprayed surfaces to verify uniformity before drying up.
- Validating the number of structures sprayed by each spray operator.
- Verifying the data recording process by the spray operators to account for their work and that of the supervisors to ensure proper tallying of a day's activities.
- Verifying the logistics supplied to each spray team against the number reportedly used, unused, and the amount available in stock.

- Evaluating the cleaning and maintenance procedures followed by the spray team.
- Verifying the washing process of PPEs and spray pumps.
- Verifying the proper procedures of progressive cleansing to ensure that spray operator washed the Hudson compression sprayer properly after the day's work.
- Verifying routine and regular maintenance of the Hudson compression sprayer according to the manufacturers' guidelines to ensure quality of the spray results.

District environmental health officers and disease control officers were regularly engaged in environmental monitoring and supervisory roles at the district levels. As part of the capacity building at the district level, the NMIMR led a two-week long entomological training session in Tamale for these officers. They took active part in collecting, monitoring, and supervising night mosquito vector collections and identification of mosquito species, and benefitted from the TOT training.

The NMCP and the regional health directorate also conducted field visits to RTI operational sites during the spray operations as part of monitoring and evaluation 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 Malaria Vector Control Oversight Committee, which is instrumental for the coordination of IRS operations across Ghana. The oversight committee includes participants from PMI, NMCP, GF/AGA, RTI, EPA, NMIMR, Ministry of Food and Agriculture, and business and industrial entities, among others. The committee, through its task teams on IRS SOPs, insecticide resistance management and training, and capacity building, have identified and developed appropriate standards and guidelines for the implementation of IRS operations in Ghana.

6.2 External Monitoring Visits

During the round of spray operations, several high profile persons visited the operations. They included the following:

- USAID Mission Director and team
- USAID Health Office Chief
- USAID Ghana PMI Advisor
- PMI/CDC Advisor
- CDC Entomologist
- NMCP Vector Control Manager
- NMCP Northern Zone Manager

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

USAID Mission Director and Health Office Chief visited IRS operations and engaged with traditional authorities and observed spray operations.

6.3 Logistics

RTI's main warehouse is located in Tamale, the Northern Regional capital of Ghana. Offices and warehouses that were obtained for use in the operational districts in the districts during Rounds 1 and 2 were maintained and also used during Round 3 implementation. Additional offices and warehouses were obtained for use in the new districts. The warehouses are located away from residential facilities to minimize environmental effects of IRS operation on both human and animal health and secure enough to prevent pilferage. Security guards were hired to provide 24-hour services in facilities in all the operational sites throughout the spray operations.

Some amount of renovation work had to be done on most of the warehouses to make them suitable for use as storage facilities. Whereas some required minor rehabilitation work, others needed complete renovation of the physical structure. All logistical items required for spraying were procured and delivered to the eight districts before commencement of spray operations. A total of 88,104 sachets of deltamethrin were procured for Round 3 operations, out of which 72,620 sachets were used. At the end of the spray round, RTI had 15,484 unused deltamethrin sachets in stock.

During this round of spray operations, the logistics manager conducted scheduled inventory inspections of all commodities and reported to the property control officer on a regular basis. On completion of the third round of spray operations, the Ghana IRS team conducted the logistics and property inventory assessment of all materials including nonexpendable and expendable commodities.

All equipment including disposable items (empty insecticide sachets, used nose masks, and used gloves) generated from all the operational sites were retrieved for storage in the Tamale warehouse before proper disposal.

Table 10 provides a summary of items distributed to the various districts.

Table 10: Matrix of Logistics Inputs for Ghana IRS Project Round 3

Districts	Spray Pumps	Boots	Coveralls	Hard Hats	Head Gear	Gloves	Face Shields	Neck Covers	Fire Extinguishers	Rinsing Barrels	Nose Masks	Jerry Cans	Insecticide Sachets Received	Poly tanks
Tolon	89	110	194	110	110	1,416	110	170	5	35	475	67	18,622	5
Savelugu	56	76	144	55	55	665	63	85	3	21	321	76	8,643	3
Karaga	35	39	74	41	31	546	43	50	2	20	214	20	6,063	2
Gushegu	41	70	132	41	41	813	41	72	3	21	275	40	7,106	3

Districts	Spray Pumps	Boots	Coveralls	Hard Hats	Head Gear	Gloves	Face Shields	Neck Covers	Fire Extinguishers	Rinsing Barrels	Nose Masks	Jerry Cans	Insecticide Sachets Received	Poly tanks
West Mamprusi	84	124	207	101	87	1,168	128	135	5	35	410	74	12,421	5
East Mamprusi	70	85	162	75	100	940	87	203	3	21	350	71	10,946	4
Chereponi	40	60	93	47	47	635	48	97	2	14	320	30	3,510	2
Saboba	45	65	114	60	60	767	80	127	3	24	310	50	5,309	3
Regional	158	97	422	146	106	50	131	0	6	26	1675	0	15,484	0
Total	618	726	1,542	676	637	7000	731	939	32	217	4350	428	88,104	27

Table 11. Round 3 Warehouse Reconciliation Report

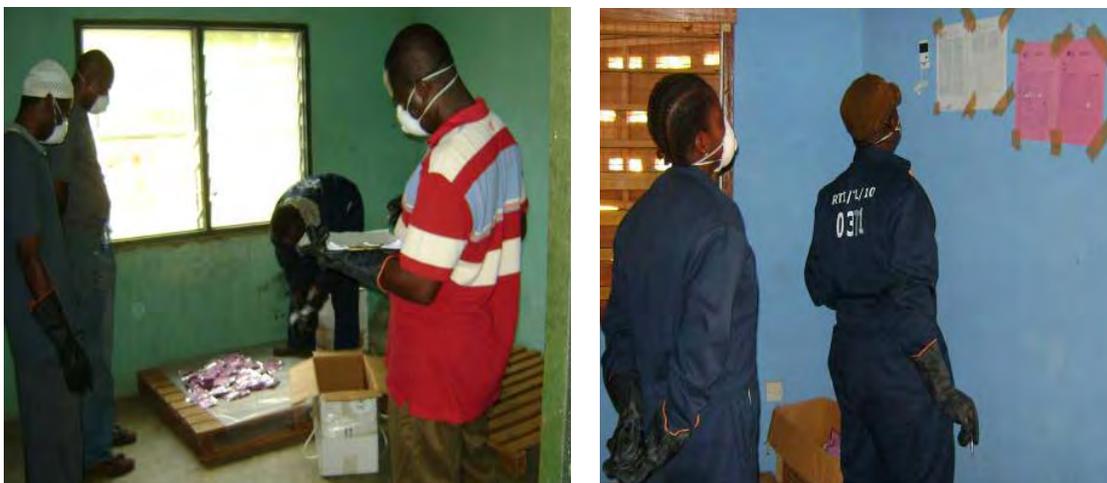
Item	Description	Outstanding Balance	New Stock Recorded	Total Stock Procured	Quantity Used	Quantity Remaining in Good Condition
1	Coveralls	852	690	1,542	1,126	1,332
2	Rubber Boots	474	252	726	632	652
3	Face Shields	481	250	731	600	429
4	Hard Hats	426	250	676	530	572
5	Head Gear	387	250	637	531	602
6	Spray Pumps	450	168	618	460	615
7	Neck Covers	539	400	939	939	644
8	Nose Masks	0	4360	4,360	2,680	1,680
9	Rubber Gloves	0	7,000	7,000	6,970	30
10	Insecticide Sachets	0	88,104	88,104	72,630	15,474



Warning signs and double lock systems put in place at district warehouses during operations.

To minimize theft and misuse of the insecticide and other IRS materials, the Ghana IRS project established protocols to control and monitor stock supplies. Listed below are some of the measures that we implemented

- All procured items (spray pumps, PPEs, etc.) were recorded using forms, checklists, and log books
- Items issued from stores or warehouse (national and district stores) were documented, and requisitions were approved and supervised by authorized staff only
- Logistics assessment and auditing were carried out on a weekly basis
- All storage facilities were properly secured (double padlocked) and security guards were at post (24 hours).
- Every sachet of insecticide was coded for easy identification and tracking at district and regional levels.
- During spray activities, every sachet opened was indicated on the spray operator's card and was witnessed by the team leader or a representative of the house who signed the data card to indicate that the sachet was opened.



Regional logistics officer inspecting chemicals (left) and thermometer readings (right) during monitoring visits to Gushegu and Tolon-Kumbungu districts, respectively.

6.4 Environmental Compliance

Dr. Gaspard Bikwemu, RTI regional senior environmental inspector visited Ghana IRS operations to ascertain RTI Ghana's level of compliance with environmental and human safety standards from June 13–19, 2010. He paid particular attention to the transportation of insecticides, provision of sanitary facilities at each operational site, safety and first aid, EPA involvement, and approval for the safe disposal of expired waste and used IRS materials.

After the inspection by Dr. Bikwemu, it was concluded that the 2010 IRS campaign in the 8 districts of the North Region of Ghana complied with the environmental requirements. The inspection noted good collaboration with EPA in environmental monitoring.

Noted areas where the RTI/Ghana IRS program excelled in Dr. Bikwemu's report include:

- Stores, soak pits, and washing areas were well prepared and managed by trained staff.
- The principal warehouse in Tamale is in the Ministry of Health regional medical stores compound where medicines and others health equipment are stored. The warehouse was well aerated.
- Secondary stores in the program districts, in general, were all in good shape and were availed by the government. They have all applied the double lock system and the store cards were well managed. The insecticides and solid wastes were stored in separate rooms from other IRS equipment.
- Soak pits and rinsing areas were fenced by local materials and locked to avoid entrance of animals and unauthorized people.
- Local health center workers were trained to manage exposures and contamination of insecticides. Keys to access the soak pits were kept by the storekeeper.

- Female spray operators and washers were tested for pregnancy and only those with negative results were accepted as spray operators. It was recommended to repeat the test every 30 days following the start-up of the spraying campaign.
- Spray operators were well trained and perform spray operations well (most of them were spray operators during the last two rounds).
- National counterparts have been trained during TOT and were involved in the supervision of spray operations (EPA and NMCP), the director of Pesticide & Registrar, Chemical Control & Management Centre in EPA (John A.PWAMANG) participated in the environmental compliance mid-spray inspection mission.
- Empty sachet management system was improved by giving a code number to each sachet to facilitate tracking. This year, Ghana sprayed Pali (Deltamethrine) packed in hydro-soluble sachets. Empty sachets are stored in boxes before organizing the final disposal.
- RTI Ghana locally procured first-aid kits for all program districts, however, they lacked the skin cream and eyewash solution.

In general, the 2010 IRS campaign complied with the environmental requirements, however, the mid-spray inspection proposed minor corrections to be corrected”

- For the soak pits, there was a need for protecting against flooding during the rain period.
- It was noted that some soak pits needed to be rehabilitated because they had been filled by silt from erosion and run offs.
- Double lock system of the secondary stores has been applied, but the keys of the two locks were kept by one storekeeper. The rationale of the double lock system is to enhance security, hence, the reason for the keys of each lock being kept by different persons. It is only when the two persons are there together that the store can be opened.
- In the principal warehouse, there were two barrels containing expired and broken sachets of Fendona insecticide from the 2008 accident, there is a need for disposal of that expired insecticide and the container.
- The empty metallic barrels stored in warehouse must also be destroyed and disposed of appropriately to avoid reuse.
- The Tamale warehouse is actually guarded by a Ministry of health guard. However for the security of insecticides, it is recommended to have RTI post another guard for better security.
- All the sites are equipped with buckets of sands but there are no shovels for using.

These findings were reported to the RTI/IRS Ghana program during the spray period which allowed the IRS team to immediately implement the suggestions from Dr. Bikwemu. For the items which could not be put into place immediately, the team completed directly following the spray campaign.

Two participants from Ghana (RTI M&E Officer and EPA Northern Region Director) attended the Environmental Management Capacity Building (EMCAB) training held in Kisumu, Kenya from June 27 to July 3, 2010. This was a regional workshop to train environmental compliance experts on conducting supplemental environmental assessments for IRS. These experts are expected to support general IRS inspections and waste disposal thereby promoting sustainability in the area of environmental compliance of IRS in Ghana.

Quality Assurance/Control of IRS Insecticides: The Ghana IRS team analyzed samples of the chosen insecticide once it arrived in the country for quality assurance purposes. Insecticide samples were collected from the batches and sent to the IRS Nairobi Regional Office to be subjected to quality analysis. Results from the batch analysis indicated an active potency level of the active ingredient of the insecticide.

Health and Environmental Safety

The health and safety of all staff including spray operators, IEC implementers, and the community were of paramount importance during the IRS operations in the beneficiary districts. PMI/RTI continues to contribute to setting high standards and establishing best practices for health and environmental safety. RTI conducted medical checkups for all its workers before their engagement and also after the spray operations. All female candidates recruited for IRS activities were given pregnancy tests before the start of spray operations and also as part of monthly review follow-up process.

Spray operators were first trained on the handling and correct application of the insecticides to prevent any hazards. PPE such as coveralls, gloves, nose and mouth masks, boots, hard hats, and face shields were also provided to spray operators. Wearing of PPE was mandatory for spray operators before embarking on daily spray operations and the usage of the PPE was routinely monitored by supervision and monitoring teams. Spray operators handed over the PPE to the washers for washing at the end of the day. The washing was done inside the fenced and locked premises of the soak pits and the hung according to WHO recommendations for proper drying, to prevent environmental contamination. Nose masks were changed daily; gloves were changed fortnightly, but replaced immediately when damaged. Danger signs and warnings were posted at the IRS sites and insecticide storage facilities to prompt and warn the general public from accessing these restricted areas to avoid any contamination and health hazards. All the stores had wash bins, clean water, and soap and towels for washing/drying hands after handling insecticides. Additionally, thatched bath houses were constructed at the operational sites for thorough body washing after field operations at the IRS sites.



Typical soak pit condition in IRS operational sites.

All offices, store facilities, and operational sites were provided with fire extinguishers and district staff trained on fire fighting techniques to fight unexpected fire outbreaks.

As mentioned, RTI Ghana, in collaboration with the Northern Regional Health Directorate (NRHD), organized a pesticide poisoning management training for prescribers, nurses and managers of health centers and CHPS zones in the eight IRS beneficiary districts to ensure safety measures.

The following measures were taken before and during IRS activities to minimize exposure to the insecticide and the potential adverse effects of such exposures:

- Eating, drinking, or smoking while working was strictly prohibited to avoid dermal exposure, inhalation, or ingestion exposure.
- Workers washed their bodies with soap and large quantities of clean water after spraying and before eating, smoking, or drinking (to avoid dermal exposure, inhalation, or ingestion procedure) to ensure safety.
- Washers washed coveralls daily to avoid dermal exposure, inhalation, or ingestion.
- A victim of accidental insecticide spillage on the skin was advised to thoroughly wash the affected areas with soap and clean water immediately to avoid prolonged dermal exposure.
- Spray operators and washers were told to inform their supervisors or team leaders immediately about any adverse side effects of the insecticide and to seek immediate health care.
- Parents, guardians, or home caretakers were advised to prevent children from coming into contact with sprayed surfaces after returning to the house to avoid any adverse side effects of the insecticide. They were cautioned not to plaster,

paint, paste pictures/photographs or hang clothes on the sprayed surfaces because these activities conceal the insecticide and reduce its effectiveness.

- All dead insects from sprayed rooms were collected and buried to avoid poisoning of domestic animals and poultry that may feed on them.
- Residents were educated to stay out of sprayed rooms for at least 2 hours after spraying.

Accident reporting forms were designed and distributed to team supervisors, drivers, site managers, and IRS office staff to record and report all accidents as a measure to promote safety.

6.5 Environmental Monitoring

Upon approval of the Pesticide Evaluation Report and Safer Use Action Plan (PERSUAP) and the Environmental Impact Assessment (EIA), the RTI Ghana team received an orientation on environmental compliance monitoring of spray operations.

The inspection completed by Dr. Bikwemu, was done during mid-spraying activities allowing the RTI/Ghana IRS team to make necessary corrections for improvement of the implementation of IRS. Regular monitoring visits were carried out by the RTI/Ghana IRS team during the spraying campaign to the operational sites to offer technical support and undertake monitoring and environmental compliance inspections.

The level of environmental compliance under this project in relation to the specific conditions stated in the PERSUAP is summarized in Table 12.

Table 12: Mitigation Activities for IRS Project

Activity	Status Update
Storage conditions	Generally in good condition with the majority adhering to minimum standards. Lighting system and security guards were available to protect the facility. Temperature and ventilation were closely monitored to suit the conditions for the storage of insecticide. Safety equipment (e.g., fire extinguishers, soap and water for hand washing, etc.) were available for use at the stores.
Prevention of environmental impacts, particularly water pollution	Spray operators received training and intensive supervision in waste management and disposal to minimize the potential risks at the well fenced and protected soak pit sites. Progressive rinse method was used during Round 3 of IRS operations.
Pregnancy testing	All females participating in IRS activities are required to take pregnancy tests during the training, prior to activities, and on a monthly basis during spraying activities. This was done by the IRS/Ghana program and 100% of female candidates completed pregnancy test.
Worker Safety	Gloves and nose masks were adequately supplied throughout the

Activity	Status Update
	<p>spray round.</p> <p>Spray operators wore the protective boots, nose masks, helmets, head gear, and coveralls throughout the field operations.</p> <p>Progressive rinse and end-of-day washing were regularly enforced. Thatched bathrooms were constructed at the operational sites for use.</p>
Residential safety	<p>Communities enforced conformity with the required safety rules:</p> <ul style="list-style-type: none"> • People stayed out of rooms for a minimum of 2 hours after spraying. • No food item, water, or cooking utensil was found inside rooms during monitoring of spraying activities. • Rooms with pregnant women or sick people who could not leave their rooms were not sprayed; these rooms were targeted for spraying later during mop up activities. • Plastic sheeting for covering furniture and food items was procured and used.
Disciplinary action to enforce compliance	<p>Twenty spray operators who violated basic standard operating procedures or code of conduct were temporarily suspended.</p>
Emergency preparedness	<p>Health workers were trained in poison management for early detection and management of accidental poisoning.</p> <p>Arrangements were made with the operational district and subdistrict hospitals and health centers for the provision of treatment medicines.</p> <p>First aid kits were made available in vehicles and warehouses for use by spray operators and other RTI staff.</p>
Spray quality	<p>Additional on-the-job supervision and training in application techniques and management of equipment was done during Round 3 of IRS operations.</p> <p>The required nozzle size (8002E) was supplied for all the spray pumps to produce a normal swath width of 29.53 inches (75 cm).</p>
Stock management	<p>All used IRS pumps received weekly routine maintenance and broken parts were repaired. Each IRS field worker had two sets of boots and coveralls to allow for washing and changing at specified time intervals. Used nose masks were changed daily; worn out gloves were changed fortnightly; and damaged ones replaced immediately with new ones.</p> <p>All used insecticide sachets were collected and transported to the Tamale warehouse for storage.</p>

Activity	Status Update
	<p>Sachet use per spray operator was recorded at the district level. A total of 72,620 sachets were used during this round.</p> <p>Stock books were kept at all the subdistrict and district warehouses. Additional recordkeeping books were provided for documentation for daily, weekly, and monthly stock management records.</p>
Disposal of sachets/waste	<p>The Ghana IRS team worked closely with the Northern Region office of the EPA to coordinate the disposal of empty sachets according to the IRS SOPs and WHO guidelines.</p> <p>The incinerator facility at the Kumasi Centre for Collaborative Research into Tropical Medicine was identified to meet the specifications for the disposal of solid waste. The waste was incinerated August 9–11, 2010.</p>

6.6 Entomological Surveillance

Entomological monitoring is an important component of any IRS program. The quality and efficacy of an IRS program can be assessed through entomological monitoring activities. These activities justify the selection of insecticides and target areas for IRS operations. Due to its benefits, entomological monitoring has been incorporated as a critical component of Ghana's PMI sponsored IRS program. The following entomology activities form the core objectives for the entomological monitoring program in Ghana:

- Tracking vector susceptibility to various insecticides in order to inform the insecticide selection for each round
- Malaria vector species identification
- Understanding the vector density and biting behavior in the area where spraying takes place in order to target operations where IRS will be most effective
- Understanding the residual effect of the chosen insecticide on the surfaces found in the targeted area in order to inform insecticide selection
- Determining the infectivity rate of the vector by evaluating the proportion of female anopheles mosquitoes in the targeted area carrying plasmodium sporozoites.
- Build capacity in Ghana in the area of entomological field monitoring and management of an IRS entomological program

The Ghana/IRS entomological implementation strategy represents a continuation and enhancement of the approach that was developed in previous program years. As a result, RTI continues to provide technical assistance in entomological monitoring for the PMI sponsored IRS program in Northern Ghana. In fulfilling this activity, RTI has

enlisted the expertise of the Noguchi Memorial Institute for Medical Research to provide oversight and quality assurance for the entomological monitoring activities in the region. NMIMR's oversight of the field activities has ensured quality of data collected and has also contributed to the building of regional capacity to be able to independently undertake entomological monitoring functions for the IRS program.

A baseline of the entomological parameters was conducted at Saboba (one of the two new districts undergoing spraying in FY10) in May 2010, and thereafter these measurements were done every two months. In one additional district, Bunkpurugu-Yunyoo, the IRS project supported baseline entomological studies (June 2010) and epidemiologic studies in preparations for commencing indoor residual spraying there in 2011. Post-spray entomological monitoring exercises conducted by the NMIMR/GHS demonstrated an acceptable level of residual pesticide activity at six months post-spray. Results of the entomological studies are being submitted on a regular basis from Noguchi to RTI and PMI to allow for regular interpretation of data throughout the year.

6.7 Closing of IRS Operations

The Ghana IRS team organized post-spray evaluation meetings in each of the eight beneficiary districts to provide all stakeholders at the district level the opportunity to present their observations about the IRS Round 3 operations and to suggest recommendations for future operations. Stakeholders present at the various meetings included chiefs and elders, DHMT members, district assemblies, women's groups, political parties, spray operators, and RTI staff.

These meetings were used as channels to show RTI's appreciation and to inform community members, especially the opinion leaders, to continue supporting IRS activities. Community members were also grateful for IRS operations in their districts and for including and employing their local youth in activities.

As previously mentioned, RTI Ghana also organized a post-IRS evaluation meeting at the regional level. Participants were mostly the community beneficiaries and our main stakeholders in the IRS program. These included the representatives from the regional health directorate, district assemblies, DHMTs, WHO, EPA, USAID, NMCP, traditional leaders/chiefs, and community beneficiaries.

Demobilization exercises for district and regional IRS operations were thoroughly carried out following IRS activities. Stock inventory and storage of IRS materials were conducted for all logistics and operational items (Appendix B).

7. Challenges

Many of the challenges faced during this spray round were similar to challenges faced during previous years, particularly those that are beyond the control of RTI. Notable among these obstacles were:

- Terrain – Poor road network and hard to reach areas. Many communities in the spray areas are inaccessible by four-wheel vehicle during the peak of the rainy

season. To overcome this challenge, where buses and pickup trucks could not go, supervisors used motorcycles and bicycles to transport spray operators.

- Communities are widely dispersed. This requires long travel times, which slows down the pace of work.
- Inadequate district and subdistrict data.
- Rains. The onset of rains also coincided with the farming season and most people are engaged in farming activities. To remedy this, spray operators visited compounds again where people were absent on the first visit and also during the mop up at the end of spray operations.
- Political and ethnic sensitivities/suspicions especially in the recruitment of spray operators. The DHMTs and the district assemblies agreed on the selection criteria and were tasked with recruiting spray personnel at the district level with guidance from RTI.
- Issues of staffing - maintaining a skeletal staff at the districts to manage post-spray issues at the community level.



Flooded roads between Gushegu and Savelugu Nanton districts proved to be difficult to carry out some activities in districts.

8. Lessons Learned

- There is proven willingness of the key partners (public and private) to collaborate on the issue of malaria control, and more specifically, IRS.
- The serialization of insecticides before issuing to spray operators helped monitor and track pesticide usage and pilferage. This also made it easy to trace pesticides to the subdistrict level and to the spray operator. Requiring spray

operators to have either a supervisor or a head of household provide a signature for each sachet opened and mixed in front of that person also added an extra level of monitoring and security to the system.

- The separate recruitment exercises conducted for the supervisors, team leaders, and spray operators ensured discipline, compliance, respect, and effective supervision channels provided a better quality control of individuals selected.
- The involvement of chiefs and other community leaders in community mobilization contributed to high acceptance rates in the communities.
- Regular follow up visits to the houses by spray operators increased the number of structures and population covered, as some people wanted to witness the insecticide's effectiveness before they allowed their homes to be sprayed.

9. Recommendations

9.1 Community Relations

- Extend feedback on impact of the IRS to the communities (direct beneficiaries) through post-spray evaluation meetings at the subdistrict and grassroots levels.
- Identify hard-working community members as eminent persons and use them together with traditional leaders to rally more support for the program. This will also boost community ownership and also enhance community acceptance of the program.
- Implement awards for communities and best performing districts. The project could institute an award process to recognize well performing communities, which can serve as models for other communities. There was a suggestion by one of the district teams representing his community members that the spray teams and district staff should be well motivated and remain employed by the project throughout the year or else they may other opportunities elsewhere and the project would lose that institutional knowledge.
- Chiefs from the beneficiary districts should be contacted and consulted on a more frequent and regular basis and be involved in the community stakeholder and mobilization meetings to obtain high coverage rates.
- Subsequent stakeholders' meetings should target recognized women's groups and their leaders who are considered role models to the other women in the communities.
- For future programs, opinion leaders should be identified and the IEC implementers work with them to promote community sensitization and ensure maximum community participation.
- There should be greater collaboration and coordination during the planning and implementing stages of IRS operations and other health interventions to achieve maximum impact.

- Intensify the use of radio programs to inform and educate people on IRS activities. The use of video documentary on malaria vector behavior will give a better understanding of the science behind IRS and hence erase misconceptions.

9.2 Human and Environmental Safety

- Environmental and personal safety campaigns should be intensified at the community levels to educate people more on the safety standards of IRS. Safety issues should not be limited to IRS operations only but should be generalized on how to manage poisoning at domestic levels.
- Fencing of soak pit areas should be made of permanent wiring materials.

9.3 Spray Operations

- Design and develop IRS handbook/guidebook for IEC implementers.
- Place personnel recruitment and retention on a more sustainable basis.

9.4 Institutional Collaboration and Partnerships

- Collaboration and partnership should be strengthened at the subdistrict level. This should include collaborative planning and implementation of IRS programs.
- Build and intensify the use of district and subdistrict IRS oversight committees.
- There should be proper coordination between IRS and other health intervention programs to avoid duplication of efforts and ensure maximum impact on the communities.
- IRS sustainability is a priority for USAID/Ghana, MOH and PMI. The RTI Ghana team will work closely with all the country partners involved in the fight against malaria, including NMCP, USAID, WHO, and GHS, to transfer capacity at all levels. An IRS sustainability plan that outlines how responsibilities for IRS activities will be transferred from RTI to NMCP/MOH during the next three years is annexed as Attachment A, and illustrates the proportional responsibility each partner will undertake for each IRS task over time. Soon after the first round, RTI will work with the NMCP to identify areas in which the NMCP and key stakeholders will take on more leadership during the planning and implementation phase for the next round of spray operations.

Appendix A. Ghana Sustainability Chart

Activity	Proportional Responsibility (%)							
	Round 1		Round 2		Round 3		Round 4	
	MOH	RTI	MOH	RTI	MOH	RTI	MOH	RTI
Partnership development								
Establish IRS oversight committees	10	90	40	60	60	40	90	10
Environmental compliance								
Prepare Environment Assessment	20	80	20	80	30	70	80	20
Environmental monitoring Plan	0	100	20	80	30	70	50	50
Environmental compliance inspection	0	100	10	90	30	70	50	50
Entomological surveillance								
Identify and train entomological technicians	50	50	50	50	50	50	80	20
Baseline survey	10	90	50	50	80	20	90	10
Periodic surveys	10	90	60	40	80	20	90	10
IEC Program								
Formative research	10	90	40	60	50	50	80	20
Training of IEC mobilizers	0	100	40	60	40	60	90	10
Production of materials	0	100	40	60	50	50	40	60
Pre-IRS IEC mobilization	10	90	30	70	40	60	90	10
IEC coordination with IRS	0	100	30	70	50	50	90	10
Post spray IEC survey	10	90	20	80	30	70	50	50
Logistics procurement and management								
Field visit for logistics needs assessment	20	80	30	70	40	60	60	40
Issue requisitions	0	100	10	90	10	90	50	50
Logistics delivery	0	100	10	90	20	80	50	50
Microplanning	30	70	40	60	50	50	50	50
Logistics chain of custody	0	100	10	90	20	80	30	70
IRS operations								
Geographical reconnaissance	10	90	20	80	30	70	40	60
Training of spray operators/supervisors, etc	10	90	20	80	20	80	20	80
Spray operations	10	90	20	80	20	80	20	80
Post-spray Activities	50	50	50	50	50	50	80	20