



PRESIDENT'S MALARIA INITIATIVE

INDOOR RESIDUAL SPRAYING FOR MALARIA CONTROL



Ethiopia Spraying Performance Report

Indoor Residual Spraying (IRS 2) Task Order One

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Abbreviations

AED	Academy for Educational Development
C-Change	Communication for Change
FMOH	Federal Ministry of Health
IEC	information, education, and communication
IRS	indoor residual spraying
ITN	insecticide-treated net
M&E	monitoring and evaluation
MCST	Malaria Control Support Team
NMCP	National Malaria Control Program
ORHB	Oromia Regional Health Bureau
PMI	United States President's Malaria Initiative
PPE	personal protective equipment
TOT	Training of Trainers
USAID	United States Agency for International Development

1. Executive Summary

Ethiopia 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. Ethiopia received funding to implement IRS under the United States President's Malaria Initiative (PMI) in 2007.

In fiscal year (FY) 2008, the IRS project in Ethiopia supported 19 districts in three zones in the first spray round. In FY 2009, PMI expanded IRS to 23 districts in four zones, and in FY 2010 PMI expanded support for IRS to 30 districts in five zones in Oromia Regional State.

PMI, in partnership with the National Malaria Control Programs (NMCP) and the Oromia Regional Health Bureau (ORHB), and in support of Ethiopia's national strategic plan, is providing technical, operational, managerial, and commodity support for IRS campaigns.

During this year's IRS campaigns, the project conducted IRS operations in two phases. Phase one focused on 24 districts beginning on June 14, 2010, and ending on July 27, 2010; phase two focused on six districts in Jimma zone with operations starting on September 1, 2010, and ending on October 8, 2010. At the end of spray operations, data from all 30 districts indicated that a total population of 2,064,389 was reached, exceeding the anticipated target of approximately 2,053,925. Out of a total of 670,487 eligible structures found, 646,870 structures were sprayed, representing an achievement of 96.5% coverage.

Out of the protected population, 338,074 children under five and 30,931 pregnant women were protected through the IRS campaign. The project found a total of 430,217 insecticide-treated nets (ITNs), and 21,989 pregnant women and 189,357 children under five had slept under an ITN the night before spraying was conducted. A total of 297,320 sachets of a pyrethroid insecticide (deltamethrin) were used during this year's IRS activities.

2. Country Background

Ethiopia was identified by the United States Agency for International Development (USAID) as one of the third wave of countries to receive funding under the PMI. PMI, the Ethiopia NMCP, and ORHB identified five epidemic-prone zones in Oromia Region—East Shoa, Arsi, West Arsi, West Hararge, and Jimma—for indoor IRS activities. In 2010, PMI and ORHB agreed to focus IRS activities in 30 districts as shown below:

- 11 districts in East Shoa
- 5 selected districts in Arsi
- 5 districts in West Arsi

- 3 selected districts in West Hararge
- 6 districts in Jimma

With PMI funding, the IRS project provides support for IRS activities by procuring personal protective equipment (PPE) and supplies, rehabilitating storage facilities, mapping areas to be sprayed, training local staff on IRS operations, delivering insecticides to IRS districts, ensuring environmental compliance, and managing spray operations, in addition to conducting pre- and post-campaign surveys to assess the effectiveness of information, education, and communication (IEC) activities and the population's satisfaction with IRS operations. The project also supports entomological monitoring and susceptibility studies.

The IRS project in Ethiopia is led by RTI International with funding from PMI in collaboration with Crown Agents USA, ORHB, Addis Ababa University's Institute of Pathobiology, Academy for Education and Development, National Environmental Protection Authority, World Health Organization, the United Nations Children's Fund, and other implementing partners.

2.1 Malaria Transmission and Burden

Malaria is the foremost public health problem in Ethiopia. Three quarters of the landmass of the country is malarious, and 54 million people (68%) live in malaria-prone areas. Transmission is seasonal and unstable, and all age groups are at risk of infection. Transmission varies from year to year (not only from place to place, but also within the same geographic area). Most malaria transmission occurs from September to November following the main rainy season. *Plasmodium falciparum* and *P. vivax* are the most common malaria parasites, accounting respectively for about 60% and 40% of cases. *Anopheles arabiensis* is the primary malaria vector in Ethiopia.

Malaria was the primary cause of outpatient consultations in 2004–2005, 2005–2006, and 2007–2008, accounting respectively for 16.5%, 17.8%, and 12% of visits, and it was the second highest cause of hospital admissions in 2007–2008. In 2006–2007, malaria was the sixth highest cause of outpatient consultations (source: Federal Ministry of Health [FMOH] health and health-related indicators).

2.2 National Malaria Strategy

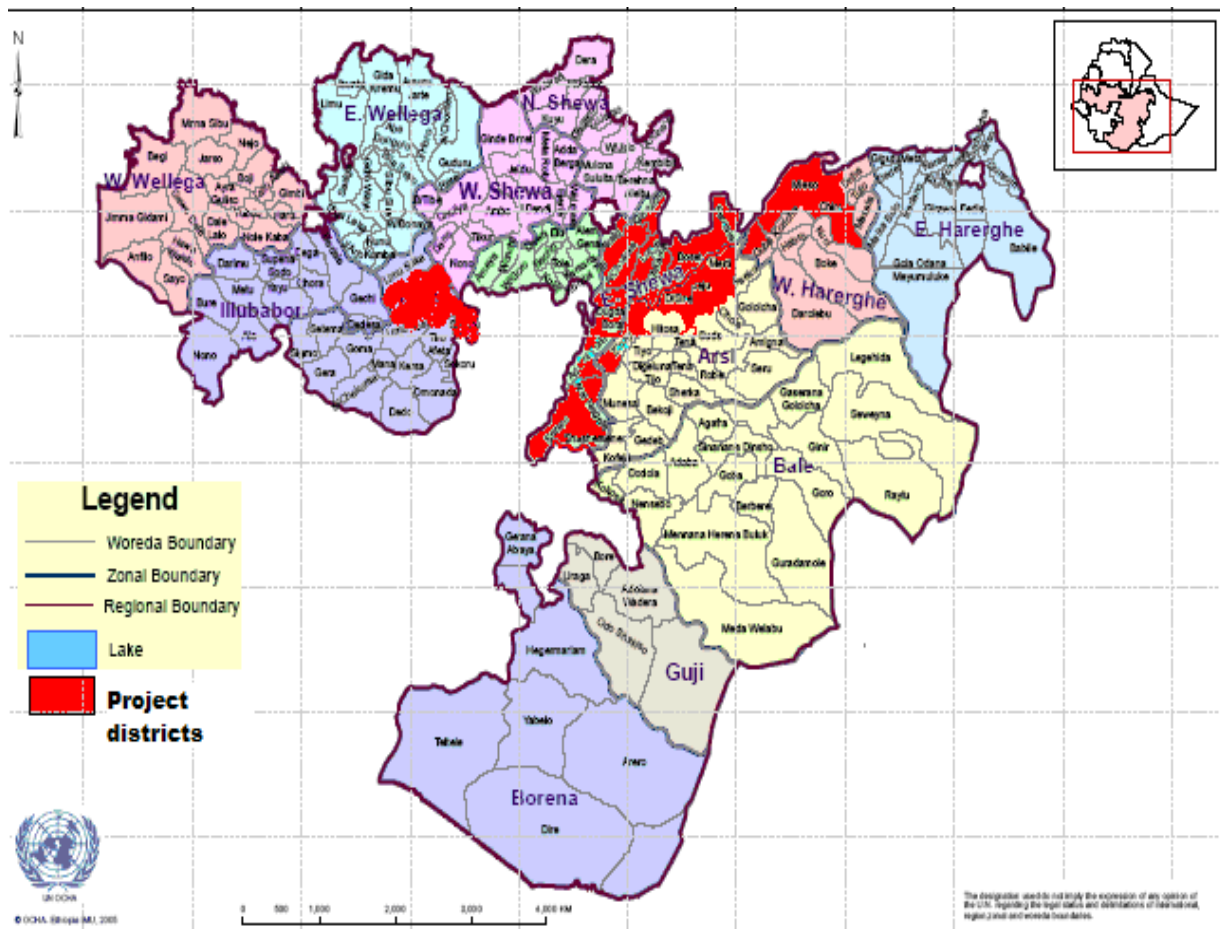
The 2011–2015 National Strategic Plan aims to eliminate malaria in areas with historically low malaria transmission and sharply reduce malaria deaths to nearly zero in all other parts of the country by 2015. The 2006–2010 National Strategic Plan aims to rapidly scale-up malaria control interventions to achieve a 50% reduction of the malaria burden, in line with Roll Back Malaria objectives

The major malaria prevention and control strategies include community empowerment and mobilization, early diagnosis and treatment, selective vector control, surveillance and epidemic control, as well as supporting strategies that include monitoring and evaluation (M&E), human resources development, and operational research.

2.3 District Selection

Because of the magnitude of the malaria problem in the Oromia region, USAID/PMI and the IRS project worked with the ORHB to select 19 districts from the Rift Valley area from East Shoa, Arsi, and West Arsi zones for Round 1 of IRS, which was conducted in 2008. With additional resources available, IRS was expanded to 23 districts in Round 2 (three new districts from West Hararge zone) in 2009 IRS operations. In FY 2010, Round 3 of IRS operations, PMI in collaboration with ORHB, selected 7 additional districts—1 from West Arsi and 6 from Jimma zone. The main criteria for selecting districts were malaria burden, size of the target population, and operational feasibility. Figure 1 shows the location of 30 IRS project districts.

Figure 1. IRS-Targeted Districts



3. Preparation for IRS

IRS training of trainers (TOT) was conducted in two separate sessions. The first session was conducted for 24 districts on May 26–28, 2010, and the second session was held on August 18–20, 2010, for 6 districts in Jimma zone. In FY 2010, the project conducted IRS operations in two phases. Phase one was conducted in 24 districts beginning on June 14, 2010, and ending on July 27, 2010; phase two of 2010

IRS operations targeted six districts in Jimma zone starting on September 1, 2010, and ending on October 8, 2010.

3.1 Geographic Reconnaissance

Once the ORHB and USAID/PMI reached consensus on the number of zones and districts with the target indicators, the RTI team, in collaboration with ORHB, convened a microplanning meeting with selected districts on December 7, 2009. Based on information provided by each district, the number of villages, households, unit structures, and population to be targeted for IRS was reached by consensus. Once this basic information was determined, the IRS project conducted an analysis to identify the IRS logistics gaps and the need for items to be procured internationally or locally.

3.2 Environmental Assessment

To maintain environmental compliance for IRS operations in Ethiopia, the RTI/Ethiopia team and ORHB conducted a logistical assessment to identify 53 sites in 30 project districts where IRS operations should take place. In response to recommendations, the project has constructed evaporation tanks in 38 sites in the last two years. Sixteen of the evaporation tanks that already existed in project districts were modified to soak pits. In the remaining 24 districts, evaporation tanks previously used for spraying activities with dichloro-diphenyl-trichloroethane (DDT), DDT-contaminated water was not dried, and thus the project constructed new soak pits for spray activities. In addition, the project constructed 15 new soak pits in the newly added six districts (Appendix B).

Based on the assessment made in newly added districts on storage conditions and on agreements reached with district health offices, the RTI/Ethiopia IRS team made substantial efforts to address the lack of appropriate storage facilities for insecticides and IRS materials. Accordingly, the project rehabilitated seven district storage facilities (six from Jimma zone and one from West Arsi zone), and those facilities are currently in use. Empty sachets, deltamethrin cartons, used rubber gloves, respiratory masks, and IRS operation wastes for this round have all been collected and transported to the central storage facility in Adama.

3.3 Logistics Needs Assessment

Ethiopia has a long history of conducting IRS. District representatives and malaria focal persons organized their IRS framework based on experience from previous campaigns. During the RTI-supported microplanning meeting held on December 7, 2009, participants developed a plan to implement PMI-supported IRS in the selected districts. The plan developed during the meeting targeted IRS in 30 districts, spraying 616,817 unit structures, and it was estimated that 2,059,925 people lived in those structures (Table 1).

Table 1. Targeted Structures and Population

Zone	Districts	Unit Structures	Total Population in Targeted Communities
East Shoa	Adama	30,060	75,679
	Adea	22,149	56,388
	Adami Tulu	32,269	115,488
	Akaki	14,189	43,995
	Boset	23,475	62,600
	Bora	16,238	50,522
	Dugda	19,815	65,779
	Fentale	19,635	48,572
	Gimbichu	2,420	5,769
	Lume	16,919	37,990
	Liben Chukala	22,034	67,469
	Subtotal	219,203	630,251
Arsi	Dodota	19,693	47,536
	Jeju	12,914	40,196
	Merti	17,008	54,754
	Sire	9,318	24,560
	Zuway Dugda	23,611	83,386
	Subtotal	82,544	250,432
West Arsi	Arsi Negele	35,552	116,947
	Shashemene	28,076	140,752
	Shalla	24,695	98,396
	Siraro	34,124	154,931
	Wondo	14,800	39,548
	Subtotal	137,247	550,574
West Hararge	Mieso	26,443	115,775
	Chiro	27,334	116,836
	Anchar	12,823	53,277
	Total	66,600	285,888
Jimma	Kersa	20,588	88,735
	Omo Nada	28,153	77,524
	Seka Chokorsa	18,558	43,329
	Shebe Sombo	10,774	46,989
	Sokoru	12,975	33,447
	Tiro Afata	19,545	46,756
	Subtotal	110,593	336,780
Total	616,187	2,053,925	

The project conducted the logistics assessment as part of the microplanning meeting with representatives from all the districts. Each district provided information on the

status of IRS equipment and logistical needs for the IRS campaign, followed by discussion to determine gaps that the IRS project could address. A detailed analysis was performed to determine the total number of spray pumps, PPE, and other IRS materials needed for IRS activities in the 30 targeted districts. The project procured commodities and equipment internationally and locally and transferred materials to the appropriate districts for support during IRS (Tables 2 to 5). The project kept some of the surplus internationally procured IRS logistics in storage as reserve stock for deployment if districts needed additional supplies.

The number and type of vehicles required by each district for IRS operations and the IEC campaign was based on the number of the IRS workforce participating in the operation and the topography of the districts. The project conducted a competitive bidding process to acquire vehicles for use during the spray operations to transport spray operators and coordinate and supervise activities; and the project selected two car rental companies—Sof Omar Car Rental and Omo Car Rental. RTI verified mileage based on dispatch slips (which listed the starting kilometer reading) and an RTI vehicle movement monitoring form, signed daily by the IRS team leaders during operation and stamped by the district health office at end the operation or at any time when a specific vehicle’s service was no longer required.

In addition to the PPE and equipment procured for the 30 PMI supported districts, the RTI/Ethiopia IRS project procured and supplied PPE and equipment to non-PMI supported districts. Items include: 1,200 spray pumps, 4,800 nozzle tips, and 360 spray pump repair kits.

Table 2. Internationally Procured IRS Logistics

Item	Quantities
Spray pumps	1,555
Nozzles tips	8,088
Respiratory masks	38,775
Spray pump kits	563
Rubber gloves	14,498
Face shields	1,443
Helmets	625
Reflective jackets	218

Table 3. Distribution of Internationally Procured IRS Logistics (from local and international vendors)

Districts	Rubber Gloves	Reflective Jackets	Respiratory Masks	Nozzle Tips	Helmets	Face Shields	Spray Pumps	Spray Pump Kits	Pregnancy Tests
Adama	704	0	2,073	144	0	0	0	0	23
Adami Tulu	783	0	2,303	116	0	0	0	0	26
Adea	508	0	1,497	130	0	0	0	0	17
Akaki	313	0	921	86	0	0	0	0	10
Arsi Negele	714	0	2,082	149	0	0	0	0	22
Bora	306	0	1,029	74	0	0	0	0	12
Boset	552	0	1,630	94	0	0	0	0	18
Dodota	525	0	1,305	95	0	0	0	0	16
Dugda	469	0	1,382	57	0	0	0	0	16
Fentale	456	0	1,305	88	0	0	0	0	16
Gimbichu	69	0	202	15	0	0	0	0	2
Jeju	350	0	870	66	0	0	0	0	10
Kersa	480	15	960	240	60	60	60	18	0
Liben Chukala	489	0	1,396	103	0	0	0	0	17
Lume	380	0	1,088	80	0	0	0	0	13
Merti	437	0	1,088	80	0	0	0	0	13
Omo-Nada	680	21	1,360	340	85	85	85	26	0
Seka-Chokorsa	480	15	960	240	60	60	60	18	0
Shalla	589	0	1,656	138	0	0	0	0	26
Shashemene	640	0	1,840	129	0	0	0	0	20
Shebe-Sombo	240	8	480	120	30	30	30	9	0
Siraro	761	20	223	160	10	10	0	0	0
Sire	262	0	653	48	0	0	0	0	8
Sokoru	320	10	320	160	40	40	40	12	0
Tiro-Afeta	480	15	480	240	60	60	50	18	0

Districts	Rubber Gloves	Reflective Jackets	Respiratory Masks	Nozzle Tips	Helmets	Face Shields	Spray Pumps	Spray Pump Kits	Pregnancy Tests
Wondo	342	20	100	71	30	50	44	10	0
Zuway Dugda	613	0	1,524	112	0	0	0	0	18
Total	12,942	124	30,727	3,375	375	395	379	111	303

Table 4. Locally Procured and Distributed IRS Materials

Districts	Tents	Mattresses	Graduated Cylinder	Funnel Filter	Pregnancy Tests	Tool Kit	Flashlights	First Aid Kits
Siraro	10	50	10	20	26	0	10	0
Wondo	10	50	20	20	12	10	10	10
Sokoru	6	40	8	48	13	8	8	8
Omo-Nada	12	85	17	68	27	17	17	17
Tiro-Afeta	9	60	12	48	19	12	12	12
Kersa	9	60	12	32	20	12	12	12
Seka-Chokorsa	9	60	12	48	18	12	12	12
Shebe-Sombo	4	30	6	24	10	6	6	6
Total	69	435	97	308	145	77	87	77

Table 5. Locally Procured and Distributed IRS Materials

Districts	Boots	Coveralls	Big Wash Basins	20 L Buckets	2 L Jugs	25 L Jerry Cans	1,500 L Water Tanker	220 L Barrels	Plastic Aprons
Siraro	20	50	2	10	10	10	1	10	2
Wondo	50	100	4	20	10	20	1	13	4
Chiro	80	0	0	0	0	30	0	0	0
Miesso	80	0	0	0	0	0	0	0	0
Anchar	40	0	0	0	0	0	0	0	0
Sokoru	50	95	4	10	15	18	2	18	4
Omo-Nada	100	196	8	20	20	20	2	20	8

Districts	Boots	Coveralls	Big Wash Basins	20 L Buckets	2 L Jugs	25 L Jerry Cans	1,500 L Water Tanker	220 L Barrels	Plastic Aprons
Tiro-Afeta	75	140	6	20	20	20	2	20	6
Kersa	75	140	6	20	20	20	2	20	6
Seka-Chokorsa	75	140	6	20	20	20	2	20	6
Shebe-Sombo	40	73	4	10	10	16	2	16	4
Total	685	934	40	130	125	174	14	137	40

Table 6 lists vehicle allocation for the IRS districts. For Gimbichu and Akaki districts, donkeys were used because of the limited accessibility by car. A total of 160 vehicles for 30 districts and 16 donkeys for Gimbichu and Akaki districts were deployed for IRS operations. Most districts also used motorcycles for supervision purposes in the villages.

Table 6. Transportation Support to Districts

Districts	Vehicle Type		Total
	Long Base	Light Track	
East Shoa Zone	3	0	3
Adama	4	4	8
Adea	4	1	5
Adami Tulu	3	5	8
Akaki	2	1	3
Boset	3	3	6
Bora	3	1	4
Dugda	1	3	4
Fentale	2	2	4
Lume	2	2	4
Liben Chukala	3	1	4
Gimbichu	1	0	1
West Arsi Zone	2	0	2

Districts	Vehicle Type		Total
	Long Base	Light Track	
Siraro	3	5	8
Shalla	1	4	5
Shashemene	4	3	7
A/Negele	7	2	9
Wondo	1	2	3
Arsi Zone	2	0	2
Dodota	1	3	4
Jeju	1	2	3
Merti	1	3	4
Sire	1	1	2
Z/Dugda	1	3	4
West Hararge Zone	1	0	1
Chiro	8	0	8
Meiso	3	4	7
Anchar	5	0	5
Sokoru	3	0	3
Omo-Nada	7	1	8
Tiro-Afeta	5	0	5
Kersa	5	0	5
Seka-Chokorsa	5	0	5
Shebe-Sombo	2	0	2
Jimma zone	2	0	2
RTI office	2	0	2
Total	104	56	160

3.4 Human Resource Requirements

During the microplanning meeting, a consensus was reached on the target IRS districts and the amount of staff needed to successfully implement IRS, including IRS

team leaders, squad leaders, spray operators, and reserve spray operators. The project also agreed that, in accordance with previous IRS Ethiopia campaigns, the team and squad leaders, supervisors, and organizers would be Federal Ministry of Health (FMOH) staff. On this basis, all districts identified their team and squad leaders based on past performance, the number of unit structures to be sprayed, district staff capacity, and their interest in executing IRS.

In preparation for spray operations, two IRS TOT sessions were conducted. The first training session was conducted in 24 districts and was held on May 26–28, 2010; the second training session, conducted in 6 districts in Jimma zone, was held on August 18–20, 2010. In total, 259 people from all 30 districts attended the IRS TOT, as summarized below and in Table 7:

- From each zone—a malaria focal person and the head or deputy head of the zone health department
- From each district—a health office head or deputy head, a malaria health worker, an environmental health worker, and IEC focal person
- IRS team leaders from each district
- The storekeeper from each district

Table 7. Training of Trainers Participants

Title	Total Staff
District managers	30
District malaria focal persons	30
IEC focal persons	30
Environmental health workers	30
Storekeepers	30
Finance assistants	6
Logistics assistants	2
M&E assistants	2
Team leaders	99
Total	259

All 30 district health offices placed job announcements in their respective areas and communities for IRS operators, washers, and security guards, indicating the corresponding position requirements. The district health offices then selected candidates based on their physical fitness for IRS, an operator’s acceptance of responsibility for IRS equipment, and the community’s endorsement of spray operators.

3.5 Training

The IRS Ethiopia project is committed to building the capacity of local staff to conduct spray operations. A crucial component of IRS is to develop a cadre of well trained spray operators who are technically sound in insecticide application techniques, can correctly handle spray pumps, and can communicate effectively with beneficiaries in the communities. The project conducted spray operators' training in the 24 districts from June 5–12, 2010 (starting and ending days varied slightly from district to district) for six consecutive days. In the six new districts in Jimma zone, the project conducted training during the fourth week of August, after the IRS logistics and PPE arrived in the districts. The six-day national training curriculum for spray operators was used to orient trainees to malaria control, spray operation planning, spray equipment, spray operation techniques, and messages to households. Moreover, the project provided additional instructions on human and environmental safety. The trainees went through a series of intensive practical application sessions to ensure they knew the correct spray technique and application of insecticide on the spray surface.

3.5.1 Training of Trainers

A TOT on spray pump maintenance and use was conducted on May 14–16, 2009, in Adama Malaria Control Reference and Training Center for 75 participants from 14 zones in the Oromia region. Retired malaria control experts from different zones of the Oromia region facilitated the training. They were given adequate time for preparation and supported by on-board malaria experts. The ORHB invited all zones to send participants. Seventy five participants (out of a total of 77 invited participants) attended the training. Mr. Michael Macdonald, USAID/Washington, visited RTI project districts during the spray pump use and maintenance TOT.

3.5.2 Training on Insecticide Poison Management

Per the approved work plan, RTI organized a training from June 12–13, 2010, on insecticide poison management, in collaboration with Black Lion Hospital and Addis Ababa University School of Community Health. Twenty five participants from 25 districts attended the training, during which participants shared their experiences, presented case studies, and obtained a high level of insecticide poisoning management knowledge. Dugda, Adea, Akaki, Fentale, and Shebe-Sombo districts did not send trainees.

Table 8. IRS Training

Type of Training	No. of Males	No. of Females	Total
Spray operators	1,841	0	1,841
Supervisor	30	0	30
Team leaders	90	5	95
Squad leaders	356	12	368
IEC mobilizers	296	980	1,276

Type of Training	No. of Males	No. of Females	Total
Washers	0	100	100
Pump technicians	72	3	75
Drivers	160	0	160
Security guards	104	0	104
Total	2,949	1,100	4,049

4. IEC Activities and Community Mobilization

4.1 IEC Activities

TOT was provided for district IEC focal persons on May 26–28, 2010, for 24 districts and in 6 districts in the Jimma zone on August 18–20, 2010. These trainers, in turn, sensitized 1,154 community and political leaders in their respective districts and trained 1,276 door-to-door community mobilizers (Table 8). These door-to-door mobilizers visited 378,788 households and provided information and instructions about the IRS campaign.

4.2 IEC Material Design and Development

Academy for Educational Development (AED)/Communication for Change (C-Change), a USAID/PMI partner, worked in collaboration with RTI/Ethiopia on the malaria IEC/behavior change communication to develop updated IEC materials adapted to incorporate the use of deltamethrin insecticide. All IEC materials were prepared in a local language (Afan Oromo) and included posters, flyers, brochures, and radio broadcasts. Figure 2 provides examples of the flyer and poster.

Figure 2. Flyer and Poster Promoting IRS



(Left) Flyer in Afan Oromo (local language) highlighting the importance of IRS for local communities. (Right) Poster illustrating IRS steps for community members.

4.3 IEC Activities

A total of 6,000 posters, 300,000 brochures, and 150,000 leaflets were distributed to all target district health offices and finally delivered to mobilizers and community members through district health offices and IRS teams. Radio public service announcements were broadcast using Oromia Radio and Radio Fana national service. Announcements aired one month before the launch of IRS and throughout the spray campaign.

Both traditional and local administrative authorities participated in the implementation of IRS through IEC training and information dissemination. These local partners played an important role in relaying IEC messages associated with malaria and informing communities when spray operators were likely to visit their households.

4.4 End-of-Spray IEC Activities

In the three years of PMI-supported IRS implementation in Ethiopia, the IRS project has gained a lot of experience regarding the importance of community awareness and mobilization for effective performance of activities. In each round, the project has improved its approach to addressing key IRS messages for anticipated communities. One of the best lessons the project learned from the past three IRS rounds is that community-based activities should be delivered to beneficiary communities through well-trained local people who are endorsed by their community and political leaders. In the future, the project will continue to focus on community empowerment and mobilization as part of the IRS implementation strategy.

5. Implementation of IRS Activities

5.1 Planning, Monitoring, and Supervision

In each district, the district health office malaria focal persons, environmental health officers, and the head of the district health office worked to organize, follow up, and supervise the daily activities of spray teams. Likewise, in addition to the supervision that the RTI/Ethiopia IRS team and ORHB malaria control department staff provided, the zonal health department heads, malaria focal persons, and environmental health officers supported and supervised districts' IRS performance. Supervisors filled out a supervisory checklist, which was signed by the squad chief and spray operators.

Strict and consistent support and prompt correction of any poor practices identified were very important for adherence to environmental compliance procedures and maintenance of quality standards for spray techniques and IRS operations. As part of standard procedure during spray operations, squad chiefs collected and completed daily spray cards for every spray operator. In addition to the standard indicators collected with the cards, the number of structures sprayed per sachet of insecticide used was also collected to help determine the number of sachets each spray operator needed each day. Through this protocol, the monitoring teams were also able to detect operational problems and implement recommendations immediately to support the

spray operations and to improve the quality of data on the IRS project. The data were compiled at the end of the work day by each squad and collected by the spray team leader. All spray team leaders then reported the results to the district malaria focal persons, who prepared the daily tracking report and forwarded it to the RTI/Ethiopia IRS team in Addis Ababa for review.

5.2 Logistics

All IRS project zonal and district health offices have malaria control focal persons who have an overall responsibility for coordinating malaria control activities, including IRS, in the zones and districts. The RTI/Ethiopia IRS project team used this government structure to organize the IRS operations in each zone and district, and without it, the campaign could not have run successfully. During FY 2011, a total of 5,890 people were deployed (see Table 8 above) to implement IRS in 30 districts. Spray operators and reserve operators (porters) constituted 31.3% of this workforce, with another 3.5% serving as washers and guards, 8.3% as technical staff (including coordinators, supervisors, and spray technicians [all FMOH]), and 21.7% as IEC and community mobilizers.

Throughout the campaign, ORHB personnel, district health workers, and RTI/Ethiopia IRS staff established a high degree of collaboration. The campaign was well organized and ran smoothly. There were challenges due to heavy rain, particularly in July and September. Some of the residents had difficulties (e.g., removing household property and keeping them outside for at least two hours in wet weather conditions was challenging).

A few key issues prevented all districts from starting IRS operations on the same day. A problem with the vehicle supplier delayed start-up by one week in some districts. Jimma zone districts started two months later, on September 1, 2010, due to delays of anticipated insecticides for IRS operations and long clearance processing of PPE and equipment into the country. Because of the varying start dates, the completion dates also varied among the districts.

5.3 Environmental Compliance

In all 30 PMI/RTI-supported project districts, rehabilitation of storage facilities and construction of soak pits were completed before the start of IRS operations. The RTI/Ethiopia IRS team, in collaboration with ORHB, has provided technical support and oversight for all districts. In addition, pre-, mid-, and post-IRS inspections were done both by the RTI team and the IRS Nairobi regional office senior environmental inspector. Used gloves and masks and insecticide-contaminated cartons were collected from all 30 districts and transported to Adama central storage to wait for final disposal.

5.4 Closing of IRS Operations

Upon completion of activities in each district, reviews and final clearance of vehicles' movement control sheets were prepared for all vehicles, and final rental payments were paid accordingly.

Moreover, spray teams returned all IRS equipment to district health offices' bases. RTI/Ethiopia IRS staff visited all districts to verify that materials were properly cleaned and safely stored. Appendix A provides a complete warehouse reconciliation report for this spray round.

6. IRS Results (Monitoring and Evaluation)

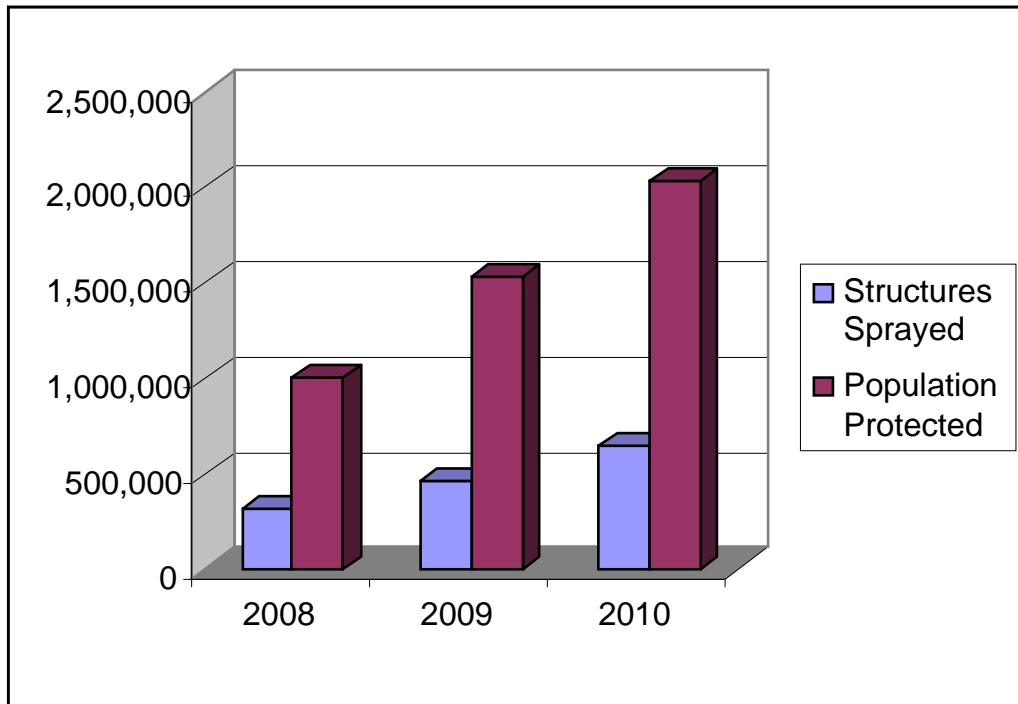
A total of 378,788 households were visited, and 670,487 unit structures were found (8% more structures than originally planned), of which 646,870 (96.5%) were sprayed.

In the sprayed structures, 2,064,389 (96.9%) inhabitants were protected against malaria. Of the total protected population, 338,074 (16.4%) were children under five years of age and 30,931 (1.5%) were pregnant women (Table 9). The number of pregnant women is lower than the national and regional rate used by the FMOH largely because, when asked, women in rural areas of Ethiopia, for cultural reasons, will not report a pregnancy unless it is visible. Hence, it is likely that early pregnancies were not recorded.

The IRS Ethiopia team's performance for most districts, both in unit structures and population coverage, is well above 90%. This year, the project emphasized raising community awareness on IRS through IEC, political leaders, schools, and religious places of worship. Moreover, the district council representatives visited districts to discuss IRS with their communities and leaders.

During the microplanning meeting for activities to take place in 2010, the daily output of unit structures per spray operator was estimated to be 14 unit structures. However, 20 districts achieved higher daily outputs of 14 or more unit structures per spray operator, and the average per spray operator for all districts was 14.5 unit structures per day. Shebe-Sombo district recorded the highest daily output of 18.5 structures per day; and Fentale, Gimbichu, and Akaki districts reported the lowest output of 10–13 structures per day. Low daily output in Fentale district was due to the inclusion of *kebeles* (villages) where communities have a nomadic lifestyle; as a result communities and structures were more scattered and difficult to reach. In Akaki and Gimbichu districts, the rainy season made the roads impassable by vehicles and contributed to low daily outputs. Even with continued expansion, RTI/Ethiopia has continued to improve its performance of IRS over the last three rounds (Figure 3).

Figure 3. IRS Ethiopia Performance from 2008 to 2010



Using this campaign as an opportunity to visit each household in targeted communities, spray teams collected information related to the use of insecticide-treated nets (ITNs). Results show that only 71% of pregnant women and 56% of children under the age of five slept under ITNs (Table 9). Given the low proportion of pregnant mothers reported, this percentage of utilization may not fully reflect reality on the ground. Furthermore, net ownership by households was almost similar to the national target (one ITN per household on average), in all 30 project districts.

Table 9. Summary of IRS Results

Zone	District	Housing Structures			Population			Pregnant Women in Sprayed Structures	Children <5 Years in Sprayed Structures	Mosquito Nets		
		Found	Sprayed	%	Protected	Not Protected	%			Total Mosquito Nets Found	Pregnant Women Sleeping under ITNs	Children <5 Yrs Sleeping under ITNs
East Shoa	Adama	31,498	29,905	94.9	77,544	2,019	97.5	813	10,145	17,873	398	6,538
	Adea	24,125	23,377	96.9	61,639	1,095	98.3	491	7,043	19,607	345	4,001
	Adami Tulu	40,270	38,990	96.9	132,307	5,206	96.2	2,133	21,965	20,069	1,519	12,368
	Akaki	14,354	14,080	98.1	37,078	578	98.5	548	4,938	8,749	496	2,193
	Boset	24,141	23,925	99.1	62,569	5,854	91.4	699	9,687	4,965	257	5,098
	Bora	17,104	16,770	98	47,825	1,275	97.4	815	1,992	8,587	453	4,902
	Dugda	18,113	17,792	98.2	62,130	987	98.4	865	10,623	6,883	537	3,202
	Fentale	21,606	19,225	89	51,886	2,928	94.7	273	6,724	12,280	203	5121
	Gimbichu	2,504	2,490	99.4	5,654	9	99.8	38	727	1,803	30	577
	Lume	18,571	17,082	92	38,845	3,017	92.8	213	3,467	11,780	161	3111
	Liben Chukala	24,925	24,923	99.9	72,837	13	99.9	1,143	13,025	1,924	241	970
	Subtotal	237,211	228,559	96.4	650,314	22,981	96.5	8,031	90,336	114,520	4,640	48,081
Arsi	Dodota	21,315	20,955	98.3	54,759	582	98.9	403	9,156	3,869	33	1,620
	Merti	18,087	17,729	98	58,402	1,066	98.2	916	9,727	7,430	1,506	4,120

Zone	District	Housing Structures			Population			Pregnant Women in Sprayed Structures	Children <5 Years in Sprayed Structures	Mosquito Nets		
		Found	Sprayed	%	Protected	Not Protected	%			Total Mosquito Nets Found	Pregnant Women Sleeping under ITNs	Children <5 Yrs Sleeping under ITNs
	Jeju	14,962	14,824	99.1	43,066	264	99.4	588	7,279	8,762	452	4,843
	Sire	10,151	9,621	94.8	26,110	799	97	198	3,540	1001	34	191
	Zuway Dugda	29,016	28,301	97.5	99,610	2,176	97.9	1,278	18,094	18,573	1,495	6,583
	Subtotal	93,531	91,430	97.8	281,947	4,887	98.3	3,383	47,796	39,635	3,520	17,357
West Arsi	Arsi Negele	36,619	35,952	98.2	122,167	1,458	98.8	2,398	20,666	43,016	2,176	18,399
	Shashemene	30,074	28,565	95	97,117	3,962	96.1	2,089	18,447	192	39	53
	Shalla	29,655	27,926	94.2	113,527	5,804	95.1	2,489	23,449	33,626	3,378	19,149
	Siraro	36,885	35,085	95.1	147,476	7,050	90.7	2,931	27,712	1,078	239	721
	Wondo	14,470	13,843	95.7	43,138	1,711	96.2	455	5,250	4,102	118	1,886
	Subtotal	147,703	141,371	95.7	523,425	19,985	96.3	10,362	95,524	82,014	5,950	40,208
West Hararge	Miesso	25,197	22,503	89.3	103,390	7,170	93.5	2,290	23,676	5,620	472	3,223
	Chiro	32,093	30,887	96.2	115,881	4,345	96.4	752	15,950	16,289	514	10,833
	Anchar	12,993	12,554	96.6	49,503	1,493	97.1	828	10,295	43,016	2,176	18,399
	Subtotal	70,283	65,944	93.8	268,774	13,008	95.4	3,870	49,921	64,925	3,162	32,455
	Sokoru	15,600	15,446	99.0	45,346	637	98.6	424	7,572	14,048	373	6,936

Zone	District	Housing Structures			Population			Pregnant Women in Sprayed Structures	Children <5 Years in Sprayed Structures	Mosquito Nets		
		Found	Sprayed	%	Protected	Not Protected	%			Total Mosquito Nets Found	Pregnant Women Sleeping under ITNs	Children <5 Yrs Sleeping under ITNs
	Omo Nada	29,257	28,600	97.8	82,768	1,495	98.2	1549	14,220	29,168	1,359	13,269
	Tiro Afata	22,299	22,155	99.4	64,883	292	99.5	1118	11,023	21,401	996	10,409
	Kersa	23,413	22,412	95.7	57,408	2,850	95.2	1014	8,923	20,524	937	8,607
	Seka-Chokorsa	18,090	17,897	98.9	54,867	636	98.8	671	8,085	31,664	656	8,002
	Shebe-Sombo	13,100	13,056	99.7	34,657	84	99.7	509	4,674	12,318	396	4,033
	Subtotal	121,759	119,566	98.2	339,929	5,994	98.2	5285	54,497	129,123	4,717	51,256
	Grand Total	670,487	646,870	96.5	2,064,389	66,855	96.8	30931	33,8074	430,217	21,989	189,357

7. Challenges

- Late decision on insecticide selection and determination of residual efficacy of deltamethrin.
- Late arrival and custom clearance of internationally procured IRS PPE (e.g., face shields, helmets, rubber gloves, and mask). Some PPE were procured locally and were of poor quality.
- Some operational workforce complained that the per diem they received during IRS operations was low and demanded increases because of the recent change in the currency exchange rate of the Ethiopian Birr.
- Intermittent daily reports were problematic in some districts: Siraro and L/Chukala.
- Low daily output and unit structure coverage in some districts, particularly during the peak of the rainy season in the six districts in Jimma zone and some districts of East Shoa zone.

8. Lessons Learned

From this third round of IRS operations, the project has learned that proper selection of districts, evidence-based planning, and timely preparation can lead to successful spraying campaigns. In general, joint planning, regular communication, implementation, and evaluation of all IRS activities with FMOH, ORHB, targeted zones, and districts engender success. The project is committed to improving and enhancing the achievements made during this round of IRS operations.

9. Recommendations

- The RTI/Ethiopia IRS project should work very closely with PMI, ORHB, FMOH and malaria control support teams for early selection of insecticide to be used in future spray rounds.
- International procured IRS commodities and materials should be received at least one month before the launch of IRS operations.
- Whenever residual life of the selected insecticide could work for six months, IRS operations should be started before the rainy season, during May, to avoid complications that heavy rains may cause.
- Because fluctuations of exchange rates are common, the project should create awareness among IRS workforce that per diem and daily wages will not be changed during the spray season because of inflation and currency devaluation.

- The project needs to strengthen the capacity of district health workers to conduct daily data collection analysis and data entry in to the M&E tracking system.

Appendix A

Warehouse Reconciliation Report

District	Sprayed Unit Structures	Deltamethrin Sachets		
		Received	Used	Balance
Adama	29,905	11,500	10,433	1,067
Adea	23,377	10,692	9,960	732
Adami Tulu	38,990	25,600	24,456	1,144
Akaki	14,080	7,000	6,493	507
Boset	23,925	8,960	8,384	576
Bora	16,770	8,000	6,547	1,453
Dugda	17,792	10,000	8,552	1,448
Fentale	19,225	10,000	5,865	4,135
Gimbichu	2,490	2,000	769	1,231
Lume	17,082	9,420	8,814	606
L/Chukala	24,923	10,000	8,974	1,026
Dodota	20,955	10,000	9,740	260
Jeju	17,729	7,000	6,707	293
Merti	14,824	10,000	9,267	733
Sire	9,621	4,633	4,500	133
Z/Dugda	28,301	15,000	14,199	801
Arsi-Negele	35,952	17,000	16,341	659
Siraro	28,565	15,608	15,236	372
Shalla	27,926	14,876	8,266	6,610
Shashemene	35,085	8,171	7,653	518
Wondo	13,843	6,437	4,862	1,575
Miesso	22,503	12,000	11,629	371
Chiro	30,887	18,840	17,688	1,152
Anchar	12,554	5,800	5,677	123
Kersa	15,446	17,536	13,562	3,974

District	Sprayed Unit Structures	Deltamethrin Sachets		
		Received	Used	Balance
Omo Nada	28,600	20,887	15,038	5,849
Seka Chokorsa	22,155	15,768	11,226	4,542
Shebe-Sombo	22,412	6,000	5,440	560
Sokoru	17,897	11,192	7,491	3,701
Tiro Afata	13,056	13,600	13,551	49
Total	646,870	343,520	297,320	46,200

Appendix B

Environmental Compliance Actions Table – From Pre and Post Environmental Inspections

Period	Key Issues	Recommendations	Actions Taken	Comments
Pre-spray	1. Soak pits	Conduct regular maintenance and follow-up. Soak pits need to be fenced in; only concrete should be used to construct wash area around the soak pits. Modification of existing evaporation tanks to soak pits	Most soak pits were maintained; all 12 soak pit areas fenced, 16 soak pits modified, and 15 new soak pits constructed and fenced	Need modification of all evaporation tanks to soak pits when dried. Cementing of washing bay for the leftover soak pits
	2. Wash areas	Wash area for soak pit should be concrete to minimize soil contamination and clogging of soak pits	12 out of 15 wash areas for soak pits were covered with concrete	All existing soak pit areas should be covered by concrete for the next operation
	3. Storage facilities	Storekeepers need additional training; equipment should be stored in accordance with standard operating procedures	Storage arrangement was done, fire extinguishers and warning sign were provided	Training for storekeepers should be planned for next operation session
	4. Bathing areas	Construct temporary bathing area	12 temporary bath areas were constructed	Standard bath areas should be constructed for Round 4
Mid-spray	1. Use of PPE	All workforce should properly use PPE during the operation, handling insecticide, removing waste etc.	Enforce and educate individual using PPE during their tasks; provide and supply quality PPE	Provision of high-quality and standard PPE to the workforce
	2. Monitoring and tracking of insecticides	Educate family members before the spray operation and remind them even after the operation on human and environmental safety standards	Community was sensitized and mobilized; the household head was informed of the importance of IRS and necessary precautions	IRS IEC message should be supported by radio and television spot messages
	3. Environmental safety	Regular check-up and inspection of soak pits, and store handling	Cleaning of the soak pit waste in three sites; store handling is observed and corrected	Periodic inspection of soak pit prevents soil contamination and clogging of the pits; ditches put in place around the pit areas

Post-spray	1. Waste disposal	All waste (e.g., empty sachets, used masks, used gloves) should be collected, stored, labeled, and transported to the central store or to its final destination	All collected waste was transported to the central Adama store; the remaining waste should be labeled	A USAID/PMI decision is needed either to transport or to incinerate the accumulated wastes
	2. Remaining amount of insecticides	Need proper recording and reporting of leftover insecticides by storekeepers to transport back to central storage facilities	Transporting to the central store; proper planning will reduce remaining stocks	Proper planning is important to reduce over stock of insecticides in the store
	3. Storing PPE	PPE equipment (e.g., overalls) should be properly stored in the store; identify PPE that can be used for the next operation and store properly	Guidance and instruction given on how to safely handle the existing PPE	Training storekeepers on store management is very important
	Store handling	All equipment in the store should be kept and stored properly	Guidance given on correctly handling equipment	Training storekeepers on store management is very important