



Senegal Spraying Performance Report

Indoor Residual Spraying (IRS 2) Task Order One

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

Prepared for:
United States Agency for International Development

Prepared by: Amadou Lamine GUEYE, Senegal IRS Program Chief of Party
RTI International
3040 Cornwallis Road
Post Office Box 12194
Research Triangle Park, NC 27709-2194

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Abbreviations

ADS	USAID's Automated Directives System
C	Celsius
CBO	community-based organization
CDC	U.S. Centers for Disease Control and Prevention
CF	ChildFund International
CS	capsule suspension
DEEC	Directorate of Environment and Classified Factories
DHMT	District Health Management Team
DPV	Plant Protection Directorate
EA	environmental assessment
EIA	environmental impact assessment
EPA	Environmental Protection Agency
F	Fahrenheit
GOS	Government of Senegal
GPS	Global Positioning System
ha	hectares
IEC	information, education, and communication
IPT	intermittent preventive treatment
IQC	indefinite quantity contract
IRS	indoor residual spraying
ITNs	insecticide treated nets
IVM	integrated vector management
km	kilometer
LNA	logistics needs assessment
M&E	monitoring and evaluation
mm	millimeter
MOA	Ministry of Agriculture
MOE	Ministry of Environment
MOH	Ministry of Health
NMCP	National Malaria Control Program
NGO	nongovernmental organization
PEA	Programmatic Environmental Assessment
PERSUAP	Pesticide Evaluation Report and Safe Use Action Plan
PMI	United States President's Malaria Initiative
PNLP	<i>Programme National de Lutte contre le Paludisme</i> (Senegal National Malaria Control Program)
PPE	personal protection equipment
RBMME	roll-back malaria monitoring and evaluation
SLAP	<i>Service de Lutte Anti-Parasitaire</i> (Pesticide Control Service)
SNEIPS	<i>Service National d'Education et de Promotion de la Santé</i>
SO	strategic objective
STTA	short-term technical assistance
TA	technical assistance
TOT	training of trainers
UCAD	Cheikh Anta Diop University
U.S	United States of America
USD	United States dollar

USAID
WHO

United States Agency for International Development
World Health Organization

1. IRS Program Summary

Since 2007, the United States Agency for International Development (USAID), with funding from the Presidents Malaria Initiative (PMI) has been supporting the Senegal National Malaria Control Program (*Programme National de Lutte Contre le Paludisme* [PNLP]) in planning and implementation of the Indoor Residual Spraying (IRS) program. From 2007-2009, the IRS program covered three epidemic-prone districts selected by PNLP—Nioro, Vélingara, and Richard Toll. In 2010, PMI supported IRS in the same three districts, and expanded coverage to three additional districts that PNLP identified as priority districts: Koumpentoum, Malem-Hodar, and Guinguinéo.

Since inception of the program in 2007, RTI has been the USAID implementing partner for the IRS program in Senegal. From 2006-2009, RTI was implementing IRS under the first USAID IRS program (IRS1, task order 1). In 2010, RTI began implementing the IRS program under the USAID IRS 2, Task Order 1, as the follow on contract to IRS1. Based on the 2010 IRS work plan, RTI was tasked with providing strategic, technical, management, and operational support for IRS activities in the six districts of Vélingara, Nioro, Richard Toll, Koumpentoum, Malem-Hodar, and Guinguinéo. RTI was also tasked to provide support to PNLP to strengthen epidemic preparedness and response plans.

1.1. Summary of Results

The Senegal IRS activities were conducted from May 10 to July 23, 2010, in the six districts mentioned above, with an average period of 38 days of spraying in each district. A total of 254,559 structures were sprayed, protecting 959,727 people, including 220,034 children under five and 25,414 pregnant women in the six districts. A total of 88,195 sachets of insecticide were used to cover the entire 2010 IRS round, including 68,571 K-Othrine sachets, 5,301 ICON[®] (lambda-cyhalothrin) wettable powder (WP) sachets, and 14,323 ICON[®] 10 capsule suspension (CS) sachets.

This Spraying Performance Report presents the project's results and achievements in the 2010 spray round, and it summarizes the lessons learned, and recommendations for future IRS programs.

2. Country Background

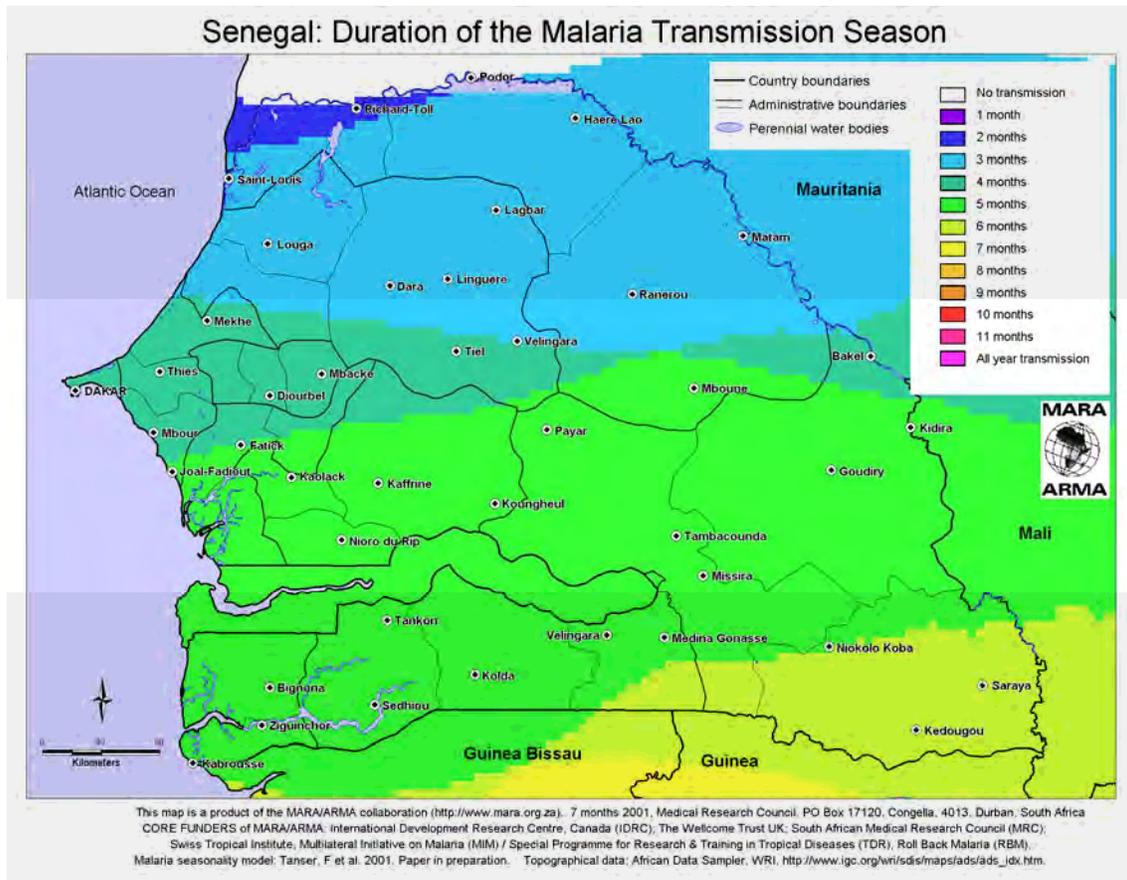
2.1 Malaria Transmission and Burden

Senegal is divided into three climatic zones of high, average, and low rainfall, corresponding to the forest in the south, the savannah in the center, and the desert zone in the north. The climate is characterized by dryness in the north and abundant rains in the south. There are two alternating seasons: a dry season from November to June and a rainy season from July to October.

The population of Senegal is approximately 12.5 million with 47% living in urban areas. The proportion of the population living below the poverty line is 62% in rural areas and 32% in Dakar.

Malaria is endemic throughout Senegal, and transmission occurs throughout the year. The three ecological zones, based on annual rainfall and the development of facilities such as dams and other water sources that persist during the dry season contribute to the outbreak of diseases and the proliferation of malaria vectors. These factors determine the duration of malaria transmission (Figure 1).

Figure 1: Duration of the Malaria Transmission Season

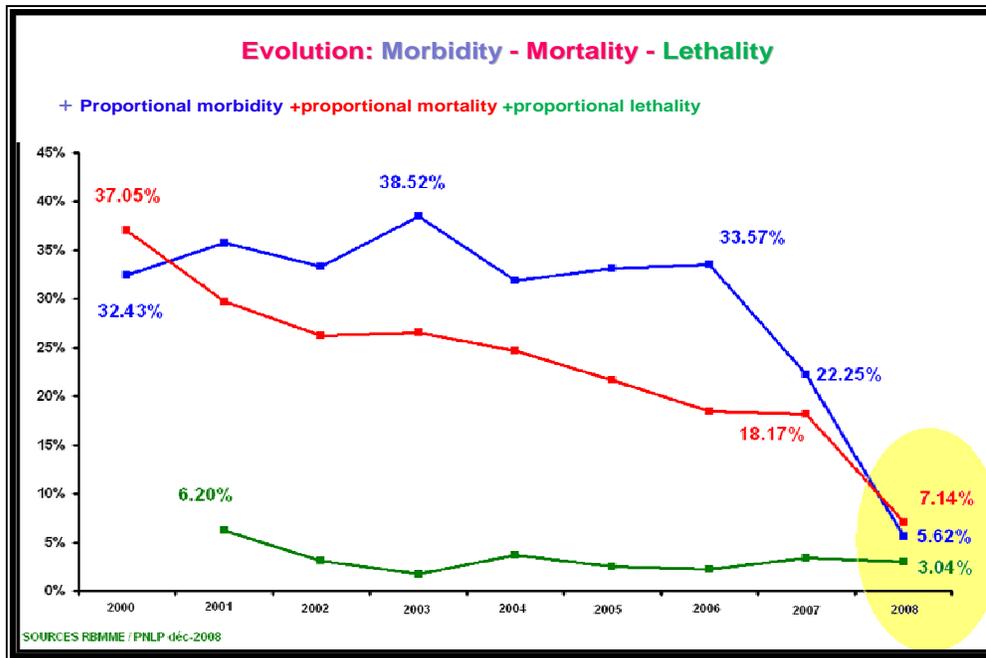


Plasmodium falciparum is the major malaria parasite species, accounting for more than 90% of infections. The main vector species are *Anopheles gambiae sensu strictu*, *An. arabiensis*, *An. funestus*, and *An. melas*. The species distribution depends on rainfall and the presence of permanent sources of water.

The proportion of all outpatient visits due to malaria decreased from 24.7% in 2007 to 3.1% in 2009. The proportion of all deaths in children under five in health facilities that were attributed to malaria decreased from 40% in 2001 to 21% in 2007 to 4.4% in 2009. The scale up of malaria prevention and treatment measures is responsible for some of this decline, but it is mostly attributed to the change in clinical case definition

in late 2007. **Figure 2** shows malaria morbidity, mortality, and lethality rates from 2000–2008.

Figure 2: Evolution of Morbidity, Mortality, and Lethality Rates



2.2 National Malaria Strategy

The Senegalese health system is organized in three levels:

- Health District level (outlying)
- Province level (medical region)
- Central level

There are 65 operational areas commonly known as *health districts*. Each district has a minimum of one health center and a network of health posts. The district covers a geographic area that may include an entire department or part of one. The covered population is between 100,000–150,000 people in a district. Health posts are established in rural community county towns or sometimes in relatively populated villages with a population of about 10,000 inhabitants, with the objective of each village having access to a health post within a 9.3-mile (15 km) radius. The health post is supported by village community facilities (health huts and rural maternity homes) created and managed by the populations.

At the *regional* level, the coordinating organization is the medical region. The region management team consists of health technicians to support the regional health officer in coordination, support, and monitoring duties.

The *central* level includes the Ministry of Health and Medical Prevention and the associated directorates and national services. Each directorate comprises health divisions and programs.

The PNLP is a part of the Disease Control Division, which is a subdivision of the Health Directorate.

The 2006–2010 Strategic NMCP Plan is structured around two major strategies:

- Strengthening prevention
- Control of malaria cases at all levels

The overall objective of the 2006–2010 Strategic Plan for Malaria Control is to reduce morbidity and mortality due to malaria by 50% by 2010. In addition, the following specific objectives are identified:

- Increase to 80% the rate of coverage and utilization of insecticide-treated nets (ITNs) by 2010.
- Treat 80% of malaria cases at all levels of the health pyramid in accordance with national directives.
- Increase to 80% coverage of intermittent preventive treatments (IPTs) in accordance with national directives.
- Cover 80% of structures in targeted zones with IRS.
- Improve program management at all levels.

2.3 District Selection

From 2007–2009, the IRS campaigns were supported by PMI funds in the health districts of Vélingara, Nioro, and Richard Toll—with each district representing one of the country’s three ecological zones.

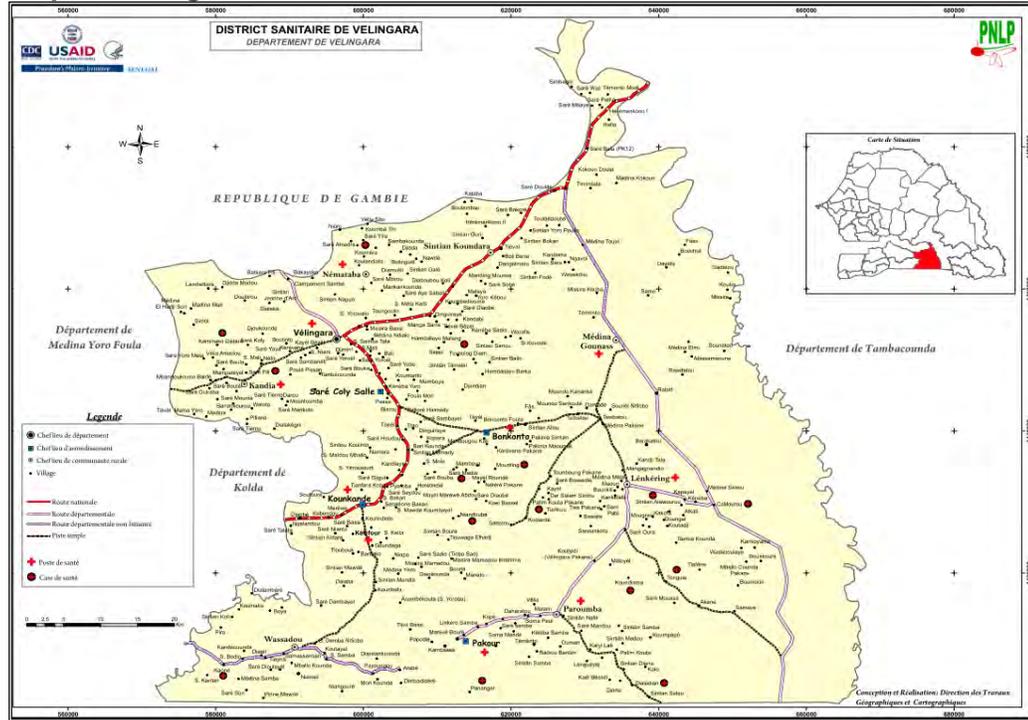
In 2010, the spray operations round was repeated between May and July in Vélingara, Nioro, and Richard Toll districts, and in an additional three new districts, Guinguinéo, Malem Hodar, and Koumpentoum. These three additional districts are among the 16 priority districts that PNLP identified as districts with high malaria morbidity and mortality.

These six IRS districts are predominantly rural and agrarian, and comprise an estimated total population of 1,054,848¹ inhabitants.

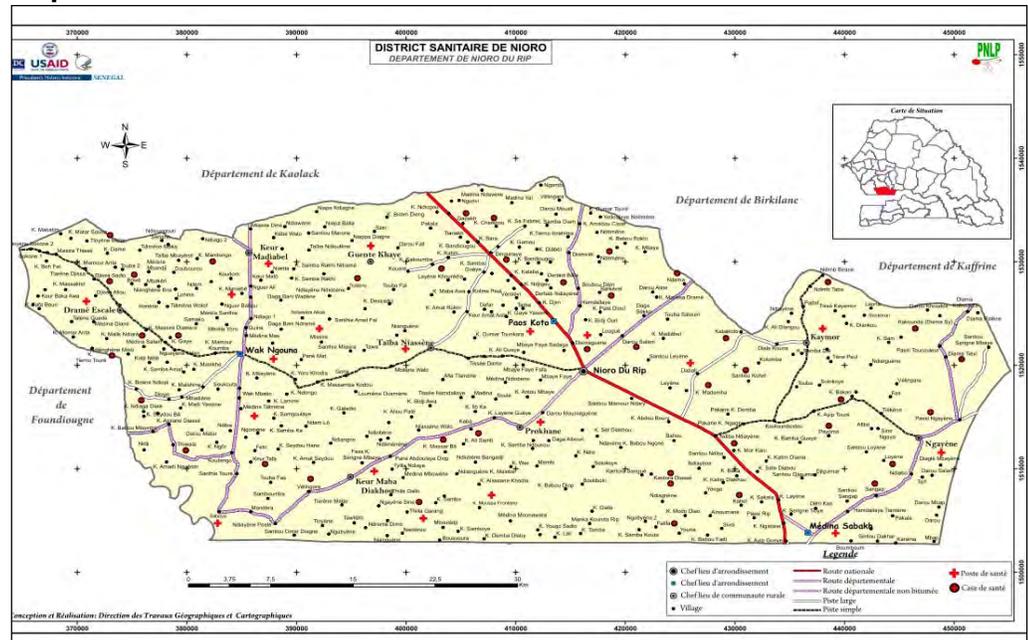
¹ Source: District Health Management Teams

Figure 3: Maps of the Targeted Districts

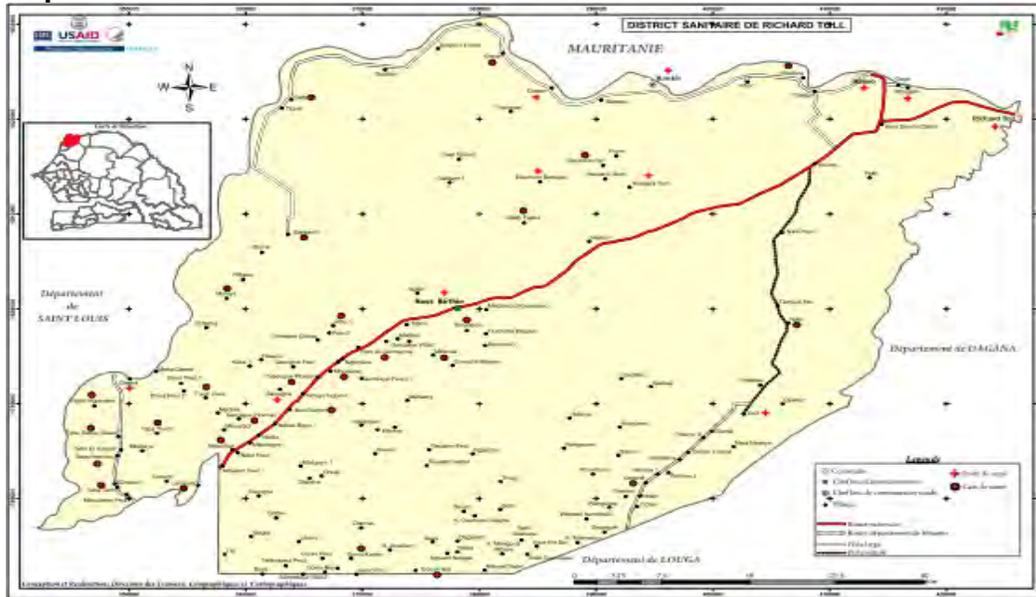
Map of Velingara



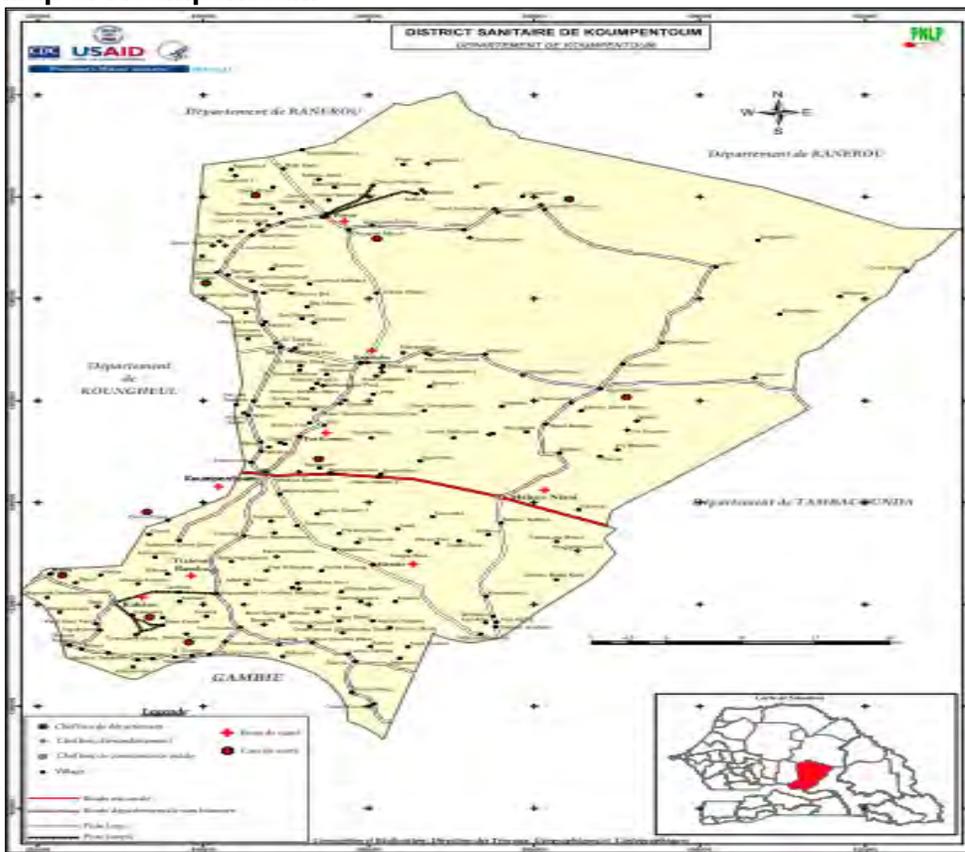
Map of Nioro



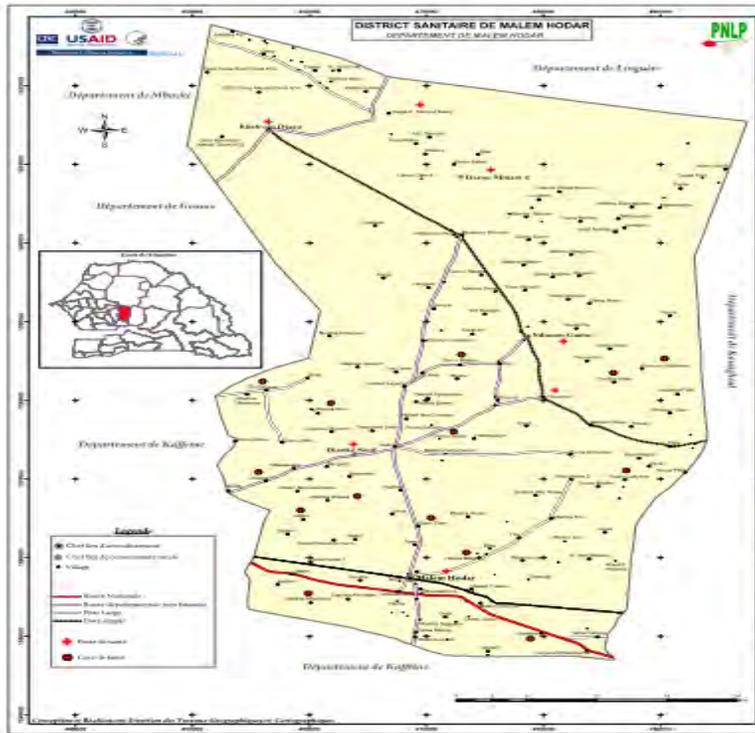
Map of Richard Toll



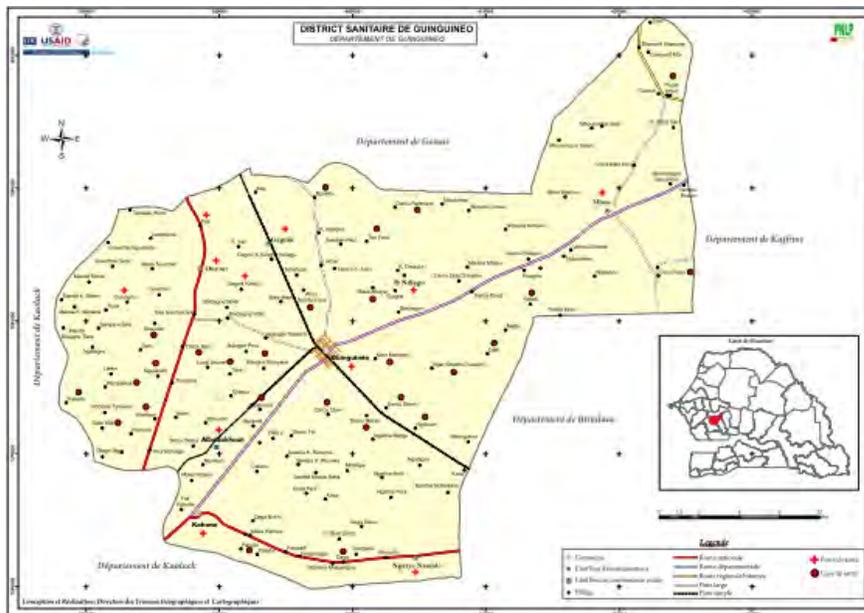
Map of Koumpentoum



Map of Malem Hodar



Map of Guinguinéo



3. Preparation for IRS

3.1 Geographic Reconnaissance

Starting in late 2009, RTI determined the managerial, logistical, and financial support required for the IRS project and associated environmental compliance activities. The assessment included site visits to the new selected targeted districts to meet with regional and district authorities. Experiences from previous rounds allowed the project to determine the exact needs in Vélingara, Nioro, and Richard Toll districts.

RTI's team, in consultation with PNL, conducted the operational needs assessment in the three new targeted districts (Koumpentoum, Malem Hodar, and Guinguiné). The purpose of the assessment was to determine the operational requirement for the implementation of IRS in the selected districts.

The assessment team comprised a logistics specialist, technical officer, and a data survey officer.

At the district level, the team also met with the key stakeholders—district health officers, nurses, administrative authorities, and cultural and religious authorities—and reinforced awareness of the IRS program.

Some of the district stakeholders assisted RTI by supplying offices and storage spaces for commodities procured for district level IRS operations. The team made reconnaissance visits to communities and villages to carry out the logistics assessment, which determines the logistical needs in the IRS target districts. The team collected all the data related to the population such as: availability of water, electricity, phone service, road, availability of transport, and local administration.

3.2 Logistics Needs Assessment

Based on the information found during the logistics needs assessment, RTI implemented logistical preparations for the 2010 round. Storage facilities were identified in all districts and materials and equipment necessary for the IRS campaign were procured.

Table 1 shows key IRS commodities that were procured for the 2010 spray round.

Table 1: Spray Operations Material Input

Item	Quantities Received
Pumps	250
Filter strainers, part no. 152-356	455
Repair kits, part no. 148-676	300
Regulation valves, part no. 148-000X	2,200
Strainers, part no. 146-617	1,200
Nozzles	1,500

Item	Quantities Received
Nozzle bodies, part no. 114-791	500
In-line filters	455
Rubber boots	540
Rubber-lined gloves	667
Face masks	4,008
Coveralls	450
Pregnancy test kits (EPT)	316
First aid kits	109
Hard hats	300
Face shields	1,500
Fire extinguishers	52
Thermometers	15
Plastic sheets	24,934 yards (22,800 meters)
Aprons	150
Boxes of soap powder	520
Boxes of detergent	32
Boxes of soap	603
Neck covers	2,248
Mobile phones	7
Digital cameras	8
Camcorder	1
Generators 2.4KVA	22
Printers	7
Printer cartridges	24
USB drives	18
Telephone handsets	18
Modems	6
T-shirts	2,938

Item	Quantities Received
Polo shirts	200
Caps	200

Warehousing

A central warehouse was rented in each district and a secondary store was set up in each zone. In most locations, only minor repairs were required (e.g., fixing door hinges, replacing some windows and vents), which the project team completed shortly after rental.

Experienced storekeepers managed all stores. Thermometers were placed throughout the warehouses, and the temperature was recorded twice daily, in the morning and afternoon. Fire extinguishers were placed in strategic locations inside and outside each warehouse, in the partitioned section and in the administrative section where offices were located. Personnel working daily in the warehouse were trained on how to use the fire extinguishers.

All products and equipment in the warehouses were stored on pallets to protect them from moisture and heat. Contaminated solid wastes were stored separately from other IRS PPE and spray equipment.

In the storerooms, insecticide was kept separate from other spray equipment. In case of an accident, informational posters were hung on the doors of secondary stores and included information on firefighters, the nearby hospital, and RTI staff phone numbers.

Vehicles

During this campaign, 36 minibuses with a capacity of 12–18 persons each and 93 4WD/DC pickups were rented at the regional level and distributed to the districts. Each field group had at least one minibus and two pickups. During the average of 38 days of IRS activities, vehicles were deployed each morning to transport spray operators to breakfast, to obtain their spray equipment, and to start the spray day. At the end of each spray day, operators were taken back to their warehouses to drop off their equipment and take their baths prior to being returned.

As in the 2009 campaign, multiple measures were used to minimize pilferage and wastage: (1) Operators were aware that any loss of material would be paid for by the person who lost it. (2) All sachets were counted and marked with the operator code number and registered on the stock card. (3) All procured items (insecticide sachet, PPE, sprayers, and other logistical items) were recorded using forms and checklists. Only authorized staff was allowed to withdraw items from stores, and each withdrawal was documented. (4) All storage facilities were retrofitted and secured to avoid break-ins. Security guards were hired to secure facilities on a 24-hour basis by rotation. In addition, a logistics assessment and inventory were conducted twice a month.

At the end of this spraying campaign, no significant loss was reported.

Soak Pits

According to WHO standards for IRS best practice, 36 soak pits were set up throughout the 6 districts at the operational sites. Fencing was put around the soak pit area and was fitted with locks to keep non-IRS personnel from coming in. The soak pit area was used for the progressive rinsing of spray pumps and for the washing of coveralls and other PPE.

The break down per district was:

- Nioro: 8
- Velingara: 7
- Richard Toll: 7
- Koumpentoum: 7
- Malem Hodar: 3
- Guingueneo: 4

3.3 Environmental Assessment

RTI, in collaboration with USAID Senegal, prepared a Pesticide Evaluation Report and Safe Use Action Plan (PERSUAP) in January 2007 to support USAID's environmental compliance regulations as required under 22 CFR 216. In addition, and as per Senegalese environmental regulations, RTI conducted a local environmental impact assessment (EIA). The environmental assessment focused on carrying out environmental analyses of vector control interventions and a situational analysis of IRS activities in the country, including pesticide use (chemical, toxicological, and ecotoxicological features). The IRS program received approvals from Senegal's Commission on Pesticides Management and from the Ministry of Environment (MOE), Directorate of Environment and Classified Factories (DEEC).

For 2010, the NMCP selected the pyrethroid class of insecticide based on efficacy against vectors in the targeted area and residual effect on wall surfaces. RTI selected the insecticide vendor through a competitive procurement process where all vendors were invited to submit a quotation based on the criteria presented by RTI. The following criteria were used to assess quotations:

- Duration of efficacy
- Pesticide registration in Senegal
- Pesticide formulation (WG vs WP)
- Risk to human health
- Risk to the environment, livestock, and agricultural trade
- Delivery times
- Cost

K-Othrine[®] wettable granules (WG) 250 (deltamethrin) was awarded the bid. In May 2010, RTI received MOE's authorization for use of this insecticide for the 2010 IRS round.

3.4 Pre-Spray Environmental Compliance Activities

Before the start of IRS, environmental compliance inspections were undertaken to ensure that all spray activities conformed to national and international guidelines. These inspections were undertaken by a commission comprising representatives from the MOE, Plant Protection Directorate (DPV), local Hygiene Service agents, local DPV agents, the fire department, and RTI. A separate inspection (pre-spray inspection) was conducted by the RTI Nairobi Regional Environmental Compliance Officer. He reviewed storage areas, insecticide management, soak pits, and stocks of PPE. His report was shared with all partners and confirmed that the Senegal Program was compliant with all environmental regulations and full prepared for the spray round.

3.5 Human Resource Requirements

The main RTI IRS office is located in Dakar and there are 5 full time RTI IRS staff members.

The core RTI staff is comprised of the following:

- Chief of Party (COP), responsible for oversight of IRS operations and client and stakeholder relations in the field
- Finance officer
- Logistics officer
- Environmental compliance officer
- Program assistant

In addition to the field office staff based in Dakar, RTI had a total of 36 temporary district level IRS staff in six of the intervention districts. These district staff were recruited for a temporary period coinciding with the IRS activities in the health districts. (See Table 2)

Seasonal personnel from the communities were recruited as IRS spray operators and auxiliary personnel. (See Table 3 for details.)

Table 2: Temporary District Operational Field Staff

Title	Total Staff
District coordinators	6
Finance assistants	6
Logistics assistants	6
Environmental assistants	6
Data clerks	12
Total	36

Table 3: Seasonal Spray Operations and Auxiliary Personnel

Title	Total Staff
Spray Operators and Supervisors	788
Store keepers	42
Washers	74
Mobilizers	2,049
Pump technicians	72
Security guards	74
Drivers	129
Water suppliers	18
Total	3,246

3.6 Training for IRS

Training activities for the period January–May 2010 are described below.

RTI aimed to build the capacity of NMCP in the technical and managerial functions of IRS by involving central, regional, and district level NCMP personnel in planning, training, and supervision of IRS.

The main capacity building activities implemented in 2010 were:

- Capacity Building in IRS Training. This involved training participants from the Ministry of Health (MOH), MOE, and MOA in strategic planning for malaria control in relation to IRS operations
- Conducting the Training of Trainers (TOT) for IRS in order to build capacity within the NMCP and MOH for training spray operators and supervisors in IRS and related activities.
- Spray operator training
- Training of physicians and nurses on poisoning case management

Table 4 below provides a summary of all personnel trained in IRS.

3.6.1 Capacity Building in IRS Planning

From January 18–23, 2010, the IRS project held a training session during the IRS Planning Workshop in Thies, 43 miles from Dakar, to increase the technical knowledge, skills, and capacity of the NMCP, MOE, and MOA staff at national, regional, and district levels.

This training involved 40 participants from all districts where IRS activities were conducted in 2010—Guinguinéo, Koumpentoum, Malem Hodar, Nioro, Richard Toll,

and Vélingara, as well as from Dakar. Participants were organized into two training sessions lasting three days each. The workshop was conducted by facilitators including Pr. Ousmane Faye from Cheikh Anta Diop University (UCAD); Dr. Lassana Konaté from UCAD; Dr. Abdoulaye Diop from PNL; Dr. Ngayo Sy from *Service de Lutte Anti-Parasitaire* (SLAP, Pesticide Control Service); Major Mamoudou Wade from SNH; Mr. Ousmane Boye from Plant Protection Directorate (DPV); Mr. Ibrahima Toure/ChildFund International; and RTI representatives (COP and Environmental Officer).

The following training content was delivered:

- General IRS
- Geographical reconnaissance
- Estimation of sprayable areas, quantification of insecticides
- Logistics needs assessment
- IRS environmental management planning
- Information, education, and communications (IEC) implementation plan

Participants were mainly agents from SNH, MOE, and MOA. Two staff from PMI also attended in this workshop.

3.6.2 Training of Trainers

After the IRS planning workshop, the 2010 spray round training of trainers (TOT) was conducted from March 4–19, 2010. The TOT was organized into three sessions. Session 1 provided scaled-up refresher training for former trainers who had already taken part in previous IRS training. Sessions 2 and 3 were tailored for newcomers mainly from the new IRS districts. The majority of trainees for all the sessions came from SNH, and others were from DEEC. The training was facilitated by Pr. Ousmane Faye from UCAD; Dr. Diop Abdoulaye from PNL; Major Mamoudou Wade from SNH; Mr. Ousmane Boye from DPV; and RTI representatives (COP and Environmental Officer).

The following modules were addressed in the training:

- Malariology and vectors
- Introduction to IRS
- IEC and IRS safety
- Sprayable areas and data cards
- Presentation of the IRS spray pump and maintenance
- Spraying techniques
- Roles and responsibilities of spray personnel and supervisors

The newly recruited IRS field office staff also took part in the training. RTI district field staff also attended training sessions that were structured around the roles and responsibilities of RTI staff, coordination of IRS activities, time charts, progression plans, and finance procedures.

Dr. Robert Perry, PMI Advisor, delivered a training session to data clerks on the use of Microsoft Access software. The COP and the PNLPS IRS focal person also took part in this training.

Another PMI representative and PNLPS's coordinator also attended this workshop.

At the end of the session, participants received training awards during the closing ceremony.

3.6.3 Training of Spray Operators

The training of spray teams was conducted in Vélingara and Koumpentoum on May 3–7; Malem Hodar on May 4–8, 2010; Guinguinéo on May 10–14; Nioro on May 18–22; and Richard Toll on June 3–7, 2010. The objective was to develop a mass of fully trained and skilled spray operators and team leaders. All the training sessions were done according to established World Health Organization (WHO) and MOH guidelines and also drew on experiences and lessons learned from previous rounds. RTI staff and MOH trainers (from TOT)—mainly from SNH, MOE, and MOA—facilitated the training sessions.

Each training session was five days long and covered the following subjects:

- Principles and planning of IRS
- Choice of residual insecticides
- Spray techniques
- Repair and maintenance of sprayers
- Calibration of sprayers
- Data entry
- Record keeping
- Stores records
- Community mobilization
- Safety of insecticide use
- Environmental health aspects

The spray operator training modules were adapted for training storekeepers, washers, guards, pumps technicians, and drivers to ensure they receive proper training for their job functions.

A specific module on fire extinguishing was delivered to the district administration teams, guards, and storekeepers.

3.6.4 Physicians Training

Training of trainers on IRS related insecticide poison management

The TOT on IRS-related poison management was held on May 3–4, 2010 in Dakar. Seven district health officers from Richard Toll, Nioro, Kaffrine, Vélingara, Koumpentoum, and Guinguinéo were trained by experts from the poison control center. The agenda was as follows:

- Presentation of the various pesticides and detailed lesson on pyrethroids
- IRS-related poison management
- The poison notification card

After being trained, trainers returned to their respective districts to provide training to nurses.



*A nurse in IRS-poison management training in Koumpentoum
Photo: RTI/R.N. Diop*

Table 4: IRS Related Training by IRS Role and Gender

Type of Training	No. of Males	No. of Females	Total
Sector managers	28	8	36
Team leaders	121	13	134
Spray operators	575	43	618
Clinicians	6	1	7
Nurses	95	30	125
NMCP, MOE, Hygiene Service staff	97	7	104
IEC mobilizers; supervisors	1788	297	2085
Washers	0	74	74
Pump technicians	72	0	72
Drivers	129	0	129
Security guards	74	0	74
Storekeepers	41	1	42
Water suppliers	0	18	18
Total	3,026	492	3518

4. IEC Activities and Community Mobilization

4.1 IEC Activities

The IEC component was managed by the ChildFund International Consortium. However, the activities below were conducted in collaboration with RTI and other IRS partners.

Coordination with Spray Operations

As in the 2009 IRS campaign, the RTI team and ChildFund International held team meetings at both field office and local staff levels to discuss how to improve IEC. These meetings also included other key stakeholders such as the district health management teams (DHMTs), community based organizations (CBOs), and neighborhood leaders.

All agreed to solve any IEC issues locally and for representatives from RTI, ChildFund, health post nurses, Hygiene Service agents, and neighborhood leaders to meet each day and discuss refusals or other IEC issues.

Community meetings were held to target community resources at village and neighborhood levels. During these meetings, participants, including administrative officers, village headmen, neighborhood leaders, notables, religious leaders, and CBO leaders, were informed of the benefit of IRS, as well as the role of the household members during the IRS campaign.

During this IRS campaign, IEC implementers also accompanied spray teams on the day of spraying in order to ensure that houses were fully mobilized by the time the spray operator arrived.

In early February 2010, IRS partners including PNLP, SNH, RTI, and ChildFund reviewed the IEC materials. The IEC tools were shared and validated during a workshop held in Kaolack on February 22–23, 2010, attended by other IRS partners, including PNLP, RTI, SNEIPS (Service National d'Education et de Promotion de la Santé), SNH, PMI/Community Health Project in districts, District Medical Officers of Richard Toll, Nioro, Koumpentoum, Malem Hodar, and Guinguinéo, and Regional Medical Officers of Kaolack, Kaffrine, Kolda, Tambacounda, and Saint-Louis.

Various activities were conducted by the ChildFund Consortium in charge of implementing the IEC component through an action plan previously adopted by DHMTs. The main communication activities were structured around the following:

- Reviewing the training materials
- Orienting DHMTs, chief nurses, and community development workers on the management of IEC during the IRS campaign
- Activity operational planning per health post/center
- Training IEC implementers on IEC messages and implementation
- Supervision of IEC implementers' training

- Advocacy to local administrative authorities, academic authorities, and other leaders, through informational visits to discuss methods of IEC implementation



*Community mobilization in Koumpentoum
Photo: RTI/C. S. Diatta*

These activities were included in the IEC implementation plan from early May 2010 through the end of the spray period.

Door-to-door mobilization was implemented before, during, and after spraying as follows:

- First visit—15 days before spray day
- Second visit—48 hours before spray day
- Third home visit—on spray day
- Final visit—24 or 72 hours after spray day

In addition, awareness campaigns were organized to target teachers and students in each village for training in post-spray compliance measures.

5. Implementation of IRS Activities

5.1 Planning

From early January to the end of March 2010, many meetings were held with IRS partners to discuss planning for IRS round 6 spraying. In January, the COP met with IRS partners individually to discuss overall planning. Additional meetings were held with PMI, PNLP, UCAD, and SNH to discuss organization of supervision for the 2010 round, IRS data collection, and the use of the remaining stock of ICON[®] WP and ICON[®] CS.

The resolutions that were agreed upon will be discussed later in this report.

District level planning of IRS operations was carried out in collaboration with district and regional health authorities. Accompanied by a PMI representative and the PNLP's IRS focal point, the COP took part in the micro-planning workshops in Vélingara, Koumpentoum, Malem Hodar, Guinguinéo, and Nioro health districts from March 22–28, 2010. During these workshops, also attended by the DHMTs, the regional health authorities, and many stakeholders, the participants agreed on the microplan for daily IRS operations in the targeted districts and on the target dates for the IRS launch and post-IRS evaluation meetings.

5.2 Spray Operations

The first spray round in the three new health districts was officially launched on May 12, 2010, in Koumpentoum. The ceremony was under the patronage of the NMCP Coordinator representing the Minister of Health and Medical Prevention, and chaired by the Prefet of Koumpentoum and the USAID Director, in the presence of Washington PMI representatives, administrative, health, and customary authorities, and local constituencies.

The Mayor of Koumpentoum, who was the first speaker, welcomed the selection of his town not only to benefit IRS, but also for the official launch. On behalf of his populations, he expressed his thanks to PMI and the American people for the support to the Senegalese Government in its carrying out the malaria control strategy. The Mayor of Koumpentoum urged his population to be cooperative and to facilitate the tasks of spray teams.

In his speech, the USAID Director expressed his warmest thanks to local authorities for taking up the challenge of the launch ceremony organization. The USAID Director reminded the audience that the IRS program is one of USAID's health program components sponsored by PMI, and that this program helped protect the lives of more than 660,000 people in Senegal against malaria during the last three years.

The NMCP Coordinator recalled that malaria is endemic in Senegal and continues to be a public health issue, as in the 43 sub-Saharan African countries. He added that thanks to the improvement of the efficiency of interventions during the last 15 years, considerable achievements were noted, thus drastically reducing malaria-related mortality and morbidity. The NMCP Coordinator thanked the U.S. Government for supporting IRS program since 2007. According to the NMCP Coordinator, the satisfactory assessment of interventions in the pilot districts of Nioro, Richard Toll, and Vélingara has motivated the extension of IRS to the three new districts, which have the highest malaria mortality and morbidity rates in Senegal.



Right to left: Mr. K. Mullaly/USAID Senegal Director, Mr. Traoré/Mayor of Koumpentoum, Mr. Aubain Sagna/Prefet of Koumpentoum, and Dr. Boly Diop/District Health Officer
Photo: RTI/C. S. Diatta



USAID Senegal and PMI Washington team at IRS Launch
Photo: RTI/C. S. Diatta

Spray activities commenced on May 10, 2010, in Koumpentoum and Vélingara; May 12 in Malem Hodar; May 18 in Guingueneo; May 24 in Nioro; and June 9 in Richard Toll.

It was strategically planned to stagger the start of IRS activities for all health posts so that spraying would start from the most difficult to reach areas and then move in closer to the operational bases. In this way, hard to reach areas were sprayed before the rains commenced.

The success of the IRS project largely depended on good organization, sufficient labor, logistics, and community members' cooperation throughout the exercise.

Compounds were required to do the following:

- Provide about 2 gallons (8 liters) of clean water for spray operators.
- Remove their property from the house before the spray operator arrives. Keep their properties outside their homes for a minimum of two hours after spraying to allow the solvent in the formulation to vaporize and dry on the sprayed surface.
- Before moving belongings back into houses, sweep up any dead insects on the floor and dispose of them in pit latrines or bury them to avoid contaminating the food chain (to prevent insects being eaten by domestic poultry).

Spraying was typically conducted from 7:30 am to 3:00 pm with five effective hours in the field after factoring in transportation and mealtime.

5.3 Supervision of IRS

For the 2010 spray round, a new supervisory manual and checklist was developed. Technical support in supervision was improved compared to the previous IRS campaigns. Supervisory support was provided by the RTI Regional Environmental Officer, the RTI in-country management team, team leaders, sector managers, Hygiene Service's supervisors, PMI team, local administrative authorities, and MOE

staff. The primary objective of IRS supervision was to ensure that spray operations were conducted in accordance with WHO technical guidelines and best practice for IRS in order to maximize effectiveness of the insecticide on sprayed surfaces, and to ensure the safety of spray operators and the community and the protection of the environment.

RTI organized spray operators into six-member teams in the previous IRS districts and five-member teams in the new IRS districts, with one person per team designated as the team leader. The team leader was responsible for supervising the spray team and ensuring quality in spraying, compliance with safety and environmental guidelines, and proper data collection. Team leaders were also tasked with distributing the insecticide and reporting on insecticide use.

Spray operators were monitored throughout the operations in order to immediately address any areas that needed to be corrected.

Each district was divided into various IRS operational areas (3 in Malem Hodar; 4 in Guinguinéo; 7 in Vélingara, Koumpentoum, and Richard Toll; and 8 in Nioro). Each operational area was supervised by one District Hygiene Service agent and one RTI sector manager. District level Hygiene Service agents rotated among operational areas on a weekly basis supervising each team and ensuring the supervisors would use the supervisor checklist developed in early April 2010. At the end of each week, the District Hygiene Service agent used a standard form for a weekly report. The completed checklists and reports were given to the district coordinator and kept on file.

Regional/national supervisory Hygiene Service staff alternated in providing continuous coverage in each district. The regional/national staff ensured district level coordination of supervision, attended district level meetings, visited each of the sector supervisors during the week to observe their work, provided direct supervision to the spray operators along with the sector supervisor, and helped the DHMTs and RTI district staff to ensure good coordination and technical implementation of IRS.

Supervision of operations included the following elements:

- Observation each spray team at work, based on a standard checklist.
- Visit a given team each day; supervise the work of each spray operator on the team.
- Ensure best practices for insecticide storage and solid waste management.
- Develop weekly reports noting strengths and weaknesses as needed and identify operators or teams that required follow up on the weaknesses or issues noted. These reports provided input on the quality of the work by team and group leaders to identify and correct problems, and to assist supervisors in resolving weaknesses or problems.
- Ensure that the compound data cards were completed accurately and promptly.
- Attend coordination meetings at their level of operations (sector or district). At these meetings, discussions addressed problems with spray operator techniques, methods to sensitize communities on spray schedules, and how

delivery of key IEC messages after spraying would be conducted, and corrective actions would be determined.



Prefet of Malem Hodar in supervision
Photo: RTI/N. Gning Cissé

Using IRS coverage data, RTI field staff evaluated the productivity of each spray team and spray operator in terms of the number of structures sprayed compared with the amount of insecticide sprayed per structure. This comparison enabled project staff to detect operational issues early and led to prompt corrective action.

5.4 Safety and Environmental Compliance during IRS

A general medical examination was conducted for all spray operators, team leaders, supervisors, washers, and storekeepers to assess their medical fitness for the IRS activities. All female spray operators and team leaders were given pregnancy tests. At the end of the spray round, another medical examination was conducted; there were no adverse reports from such examinations.

Operators' occupational exposure to the insecticide was minimized by the use of PPE. The spray operators were provided with helmets, face shields, nose and mouth masks, long-sleeved cotton overalls, rubber gloves, pairs of cotton-rich stockings, robust gum boots, and with neck covers.

During the spray round, there was a reported Forty-three insecticide related adverse events - 33 among the spray operators and 7 among the beneficiaries. All the cases were minor and were managed by the health nurses.

In summary, the following measures were taken before and during IRS activities to minimize exposure to the insecticide and its potential adverse effects:

- Prohibiting eating, drinking, or smoking while working (to avoid dermal exposure, inhalation, or ingestion exposure)
- Ensuring that workers washed their hands and faces with soap and a large quantity (about 2 liters) of clean water after spraying and before eating, smoking or drinking (to avoid dermal exposure, inhalation, or ingestion exposure)
- Washing of coveralls by the washers to avoid dermal exposure, inhalation, or ingestion exposure

- Advising workers to wash the affected area(s) with soap and water immediately, in the case of accidental spillage of insecticide on the skin (to avoid prolonged dermal exposure)
- Advising spray operators and washpersons to immediately inform the supervisor or team leader about any adverse side effects of the insecticide (to seek health care early)
- Advising parents, guardians, or home caregivers to prevent children from coming into contact with sprayed surfaces after returning to the home (to avoid the transitory side effects of the insecticide); and to avoid plastering, painting, and placing pictures/photographs on the sprayed surfaces because these activities conceal the insecticide and reduce the sprayable surface).

The IRS Regional Environmental Officer visited Senegal to carry out the mid-spray environmental inspection. He inspected soak pits, insecticide storage, use of PPE and washing procedures as well as the incineration site. His findings and recommendations can be seen in Appendix C.

Involvement of the Environment Directorate

To reduce or minimize the potential IRS-related social and environmental impacts to an acceptable level, the Environment Directorate and its province branches participated actively in conducting evaluations of the 2010 IRS Social and Environmental Management Plan. The Environment Directorate is the focal point for all conventions relating to the management of chemicals such as the pesticides used in IRS operations (Basel, Rotterdam, and Stockholm conventions).

- **During the pre-IRS campaign**

The heads of the regional environmental branches in Kolda (for the health district Vélingara), Kaolack (for the health districts Nioro, Malem Hodar, and Guinguinéo), and a representative of the Environment Directorate for the health districts Koumpentoum and Richard Toll took part in the validation of the 2010 IRS centers from February to March 2010 and also took part in the IRS TOT in Mbour (Thiès) during March 4–19, 2010.

- **During the IRS campaign**

Agents from the regional environmental branches in Kolda (for the health district Vélingara), Kaolack (for the health districts Nioro, Malem Hodar, and Guinguinéo), and a representative of the Environment Directorate conducted the 2010 IRS environmental compliance inspection according to the following calendar:

- May 19–July 21, 2010—health districts of Nioro, Malem Hodar, and Guinguinéo
- June 15–19, 2010—health district of Vélingara
- July 9–14 July—health districts of Richard Toll, Malem Hodar, and Nioro.

An officer from the Environment Directorate took part in the validation of the selection of the Diourbel incinerator once it becomes operational.

- **During the post-IRS campaign**

An officer from the regional environmental branch in Thiès joined in the collaboration with the PROPLAST plant for the recycling of 490 empty IRS K-Othrine[®] pails for the 2010 campaign.

Officers from the Dakar Environment Directorate and the Diourbel regional environmental branch also joined the collaboration between RTI/Diourbel Regional Hospital/DEEC.

These persons will continue supporting the IRS program through the daily supervision of recycling and incineration operations, strictly complying with hygiene, safety, and environmental rules.

5.5 Monitoring and Evaluation (M&E) for IRS

Data Recording

Spray operators were trained in data collection and required to collect compound level data on their daily activities on a spray card.

The following data were recorded on each spray card:

- Number of compounds
- Number of buildings in a compound (equivalent to number of structures)
- Number of rooms in each structure
- Number of people living in the sprayed structures (including the number of children under 5 and pregnant women)
- Number of people living in the unsprayed structures (including the number of children and pregnant women)
- Number of insecticide-treated or ordinary bed nets

Spray teams also recorded the number of K-Othrine[®] wettable granules (WG) 250 sachets received, used, and returned at the end of each workday.

Structures that were not sprayed were also recorded on the spray operator's daily card along with a code corresponding to the reason why a structure was not sprayed. The most common reasons for not spraying were that a household was not prepared or a structure was locked.

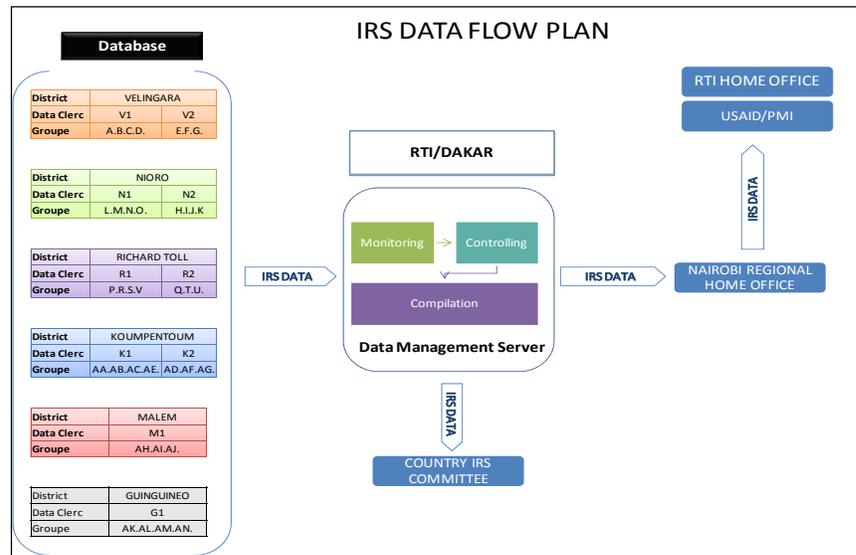
Data Entry

With a goal of simplifying the past data collection system, IRS partners (RTI, PNLP, UCAD, PMI/CDC) in Senegal have decided on direct entry of data from spray operator forms into a Microsoft Access database.

Twelve data clerks (2 Nioro, 2 Guinguinéo, 2 Kompentoum, 1 Malem Hodar, 2 Vélingara, 2 Richard Toll, and 1 from the central level) were trained on how to start the Microsoft Access program; open the data entry screens; enter data from the paper forms; and validate, back up, and transmit the data to RTI/Dakar (central level). The Data Manager at the central level compiled the data transferred from the six districts. The Data Manager handled the importing, organizing and management of the

centralized database. He was responsible for preparing summary reports, including the weekly tracker, and liaised with other partners on IRS data collection and reporting. **Figure 4** shows the IRS data flow plan.

Figure 4: IRS Data Flow Plan



Data Security

IRS data backup was done at the end of each day at the district level on flash disks and CD-ROMs. The batches of the hard copies were clearly labeled and filed. Data clerks sent the daily reports by e-mail directly to RTI/Dakar, where the central level data coordinator verified the transferred files and transmitted the information to local IRS partners and to IRS/Nairobi (see **Figure 4**).

The Nairobi Regional Monitoring and Evaluation (M&E) Officer provided STTA to Senegal during the 2010 spray round planning period. She reported the following observations:

- The program is efficient, allowing direct entry of data from spray operator forms into the database (reducing manual compilation errors), and it has the ability to group and transform data into report summaries. The system can automatically calculate data by any category requested, and the program facilitates reading and interpretation.
- The system can link a structure sprayed during mop-up (second visit) to the regular spray campaign data (first visit). The system automatically revises and merges this information, thereby reducing the possibility of double entry or counting.
- The centralized and decentralized systems are linked. Data is easily sent to the central level and back to district stakeholders such as DHO (district health office) and IEC, and to RTI field operators through daily/weekly summaries. Essentially, the purpose of these communications is to use the data as a quality improvement tool.

5.6 Closing of IRS Operations

RTI organized a post-spray evaluation meeting at health post and district levels to solicit views and feedback on the spray round from all stakeholders and partners.

The main topics discussed and recommendations made were in the following thematic areas:

- Community education and mobilization
- Targeted mosquitoes
- Human and environmental safety
- Payment of spray operators

RTI also organized closing ceremonies in all the beneficiary districts. The purpose of the closing ceremony was to provide all stakeholders at the district level the opportunity to present their observations about the IRS operations in their various communities.

RTI used the closing ceremonies to thank the communities, particularly the opinion leaders (administrative, cultural, religious, and health authorities) to continue to support IRS activities. During this ceremony, all IRS participants were given awards for taking part in IRS operations.

6. IRS Results (Monitoring and Evaluation)

The program was successfully implemented, yielding a high coverage rate of 97.9% (eligible structures sprayed/eligible structures found). In addition, the application rate of the insecticide was within the manufacturer's recommended range: 1 sachet per 4.5 rooms.

The number of eligible structures found was 259,957, with 254,559 being sprayed.

At least 85% of targeted structures were sprayed in 2,191 villages. The coverage was less than 85% in 53 small villages that have an average of 37 structures per village.

Figure 5 further defines the structures sprayed and **Table 5** shows the full summary of IRS results.

Figure 5: Structures Sprayed in 2010

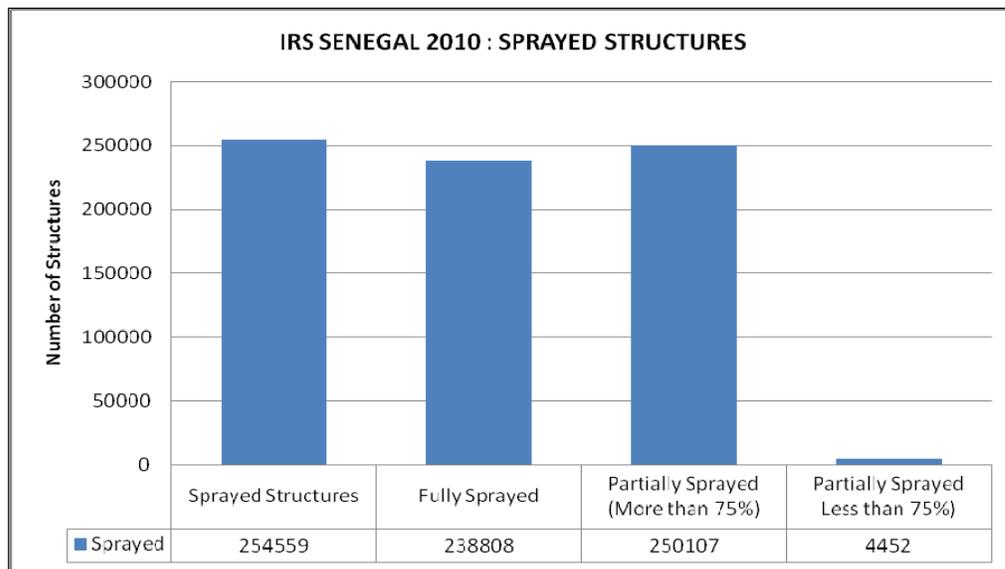
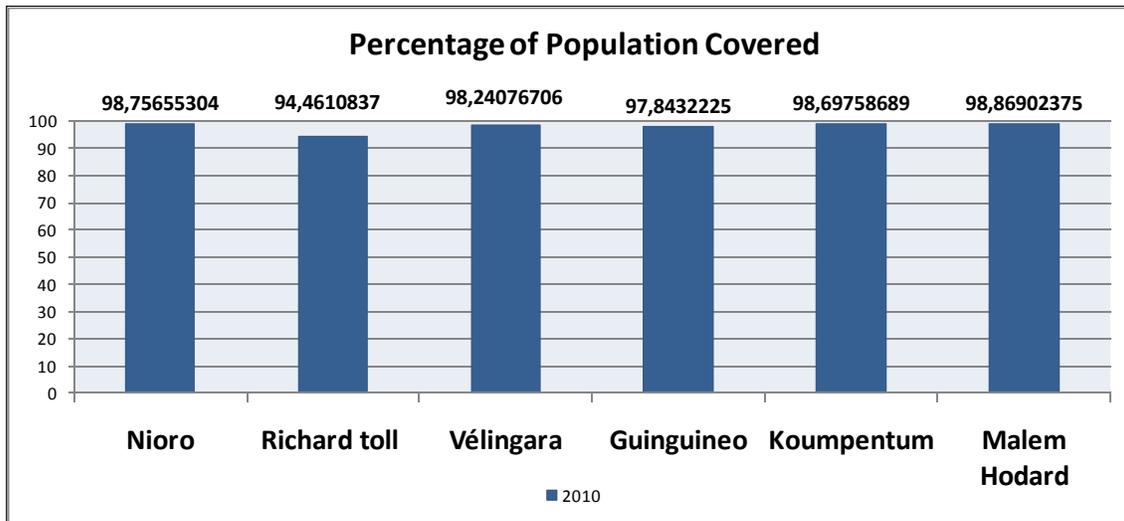


Table 5: Summary of IRS Results

Indicator	District	No. Structures Sprayed	No. Structures found eligible for Spraying	No. People Residing in Structures Sprayed (Population Protected)	No. Pregnant Women Residing in Structures Sprayed	No. Children <5 yrs. Residing in Structures Sprayed
1	Guinguinéo	25,305	25,954	103,524	2,056	21,938
2	Koumpentoum	34,552	35,135	112,231	3,118	26,868
3	Malem Hodar	26,991	27,356	83,835	1,924	18,512
4	Nioro	68,100	69,060	280,120	6,651	71,091
5	Richard Toll	25,666	26,851	120,794	2,365	22,883
6	Vélingara	73,945	75,611	259,223	9,300	58,742
	Totals	254,559	259,967	959,727	25,414	220,034

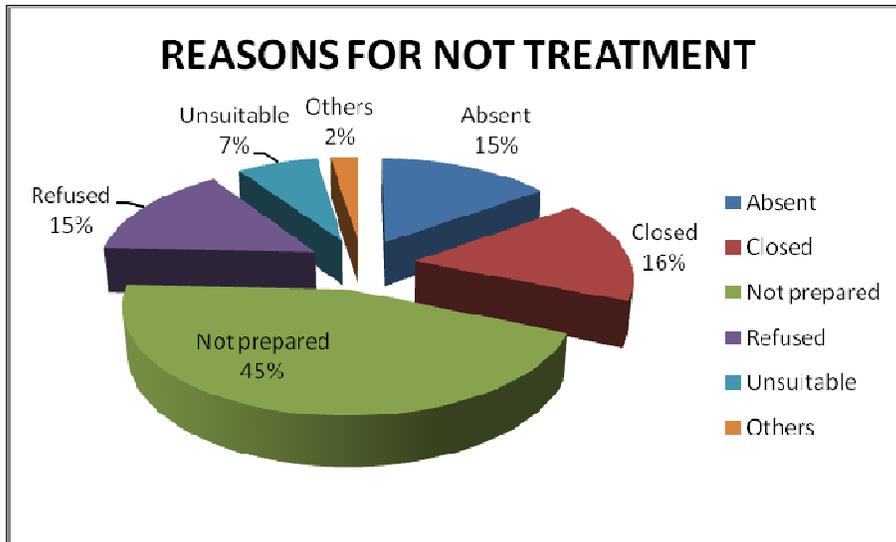
The total population protected was 959,727. Of this total, 25,414 were pregnant women and 220,034 were children under five years of age. **Figure 6** shows the percentages of population protected by district.

Figure 6: Percentage of Population Covered



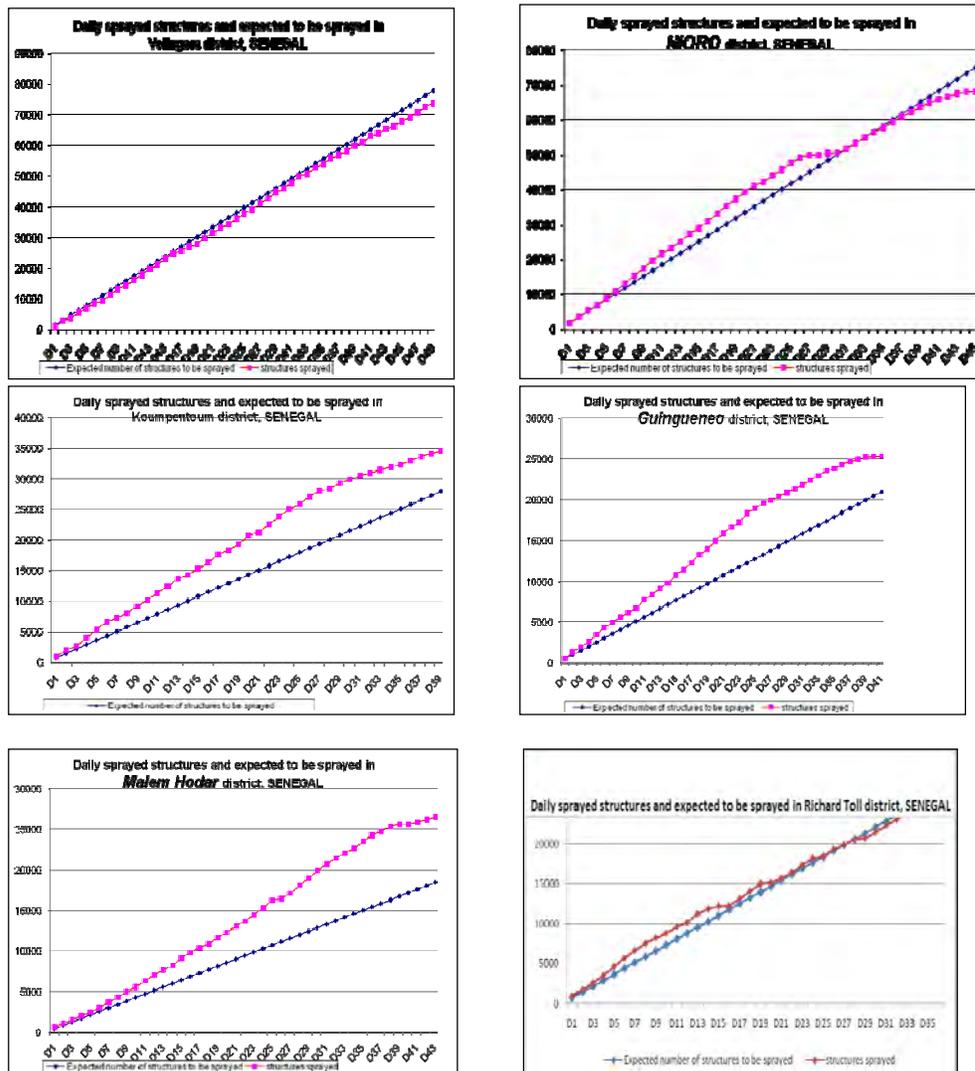
A total of 5,408 structures out of 259,967 were not able to be sprayed. **Figure 7** shows the reasons for structures not sprayed.

Figure 7: Reasons for Unsprayed Structures



Each district's daily spray progress was tracked against the target end date. The results can be seen in **Figure 8**.

Figure 8: Daily Structures Sprayed Vs. Targeted Structures to be Sprayed in the Six Districts



The below shows the quantities of insecticide used during the campaign and the amounts remaining.

Table 6: K-OTHRINE & ICON Used in Districts

	Guinguénéo	Malem Hodar	Koumpentoum	Nioro	Vélingara	Richard-Toll
K-Othrine received	10,200	10,198	20,400	30,000	15,000	4,200
K-Othrine used	8,646	9,272	10,438	26,362	13,823	30
K-Othrine remaining	1,554	926	9,962*	3,638	1,177	4,170
ICON WP received	0	0	0	0	0	5 301
ICON WP used	0	0	0	0	0	5 301

	Guinguinéo	Malem Hodar	Koumpentoum	Nioro	Vélingara	Richard-Toll
ICON WP remaining	0	0	0	0	0	0
ICON CS received	0	0	0	0	9,000	5,323
ICON CS used	0	0	0	0	9,000	5,323
ICON remaining	0	0	0	0	0	0
* 5,000 sachets of remaining quantity of K-OTHRINE have been sent to IRS MALI						

7. Lessons Learned

- **Country ownership and utilization of government officials**

Significant emphasis was placed on using government staff (health post, district, and central levels) for various components of project implementation in this round. The RTI Senegal IRS team worked daily in excellent collaboration and consultation with PNLP at the central and district levels, with key stakeholders at the district level, and with MOE throughout operations, particularly in supervision that was conducted by the Hygiene Service and MOE.

- **Cleaning and maintenance of spray equipment**

Hiring pump technicians to manage the progressive rinse and maintenance of spray cans was highly effective in reducing the damaged spray equipment during the last spray campaigns. To date, after four years and six rounds, only 1.2% of spray cans are faulty.

- **IEC and community mobilization**

IEC played a key role in informing of IRS activities, ensuring the safety of beneficiaries, and protecting the environment. In some villages—particularly in small villages—the residents were unaware of the IRS program and what they should do before, during, and after spraying. Later it was realized that IEC activities did not start before spraying in these villages. Maximum coordination at district level is needed to ensure that the right messages are delivered sufficiently in advance of spraying.

8. Recommendations

- The high level of country ownership and the utilization of government officials was successful in building capacity and creating ownership of the IRS program at all levels. Continuing to involve MOH, MOE, and administrative authorities in all aspects of IRS will be critical for scaling up IRS and the eventual turnover of IRS to the Government of Senegal.
- Increase training in spray equipment cleaning and management.

- Increase monitoring and supervision of spray equipment use.
- Provide IEC implementers with some means of transportation (bicycles or motorbikes) to easily reach small villages.
- To address community concerns that IRS is not having any effect on the mosquito populations, the main purpose of IRS (targeting indoor resting, malaria-transmitting mosquitoes to decrease mosquito-human contact) should be better conveyed through appropriate IEC strategies and messages.
- IEC media message activities should start very early so people who leave their homes during the day and cannot be reached by door-to-door IEC implementers have a chance to hear the message through some other means, such as radio and other communication channels.
- Technology such as Global Positioning System (GPS) to equip spray operators with maps of the sectors in which they work should be piloted to evaluate benefit to the program
- Use of the IRS household card would benefit the IRS Program by enabling NMCP and MOH to track household participation in IRS over the next 4 years. It would also assist in supervision of spray activities by indicating households that have been visited by the spray operator and supervisor.

9. IRS in Action – Success Stories from Senegal 2010 Spray Round

In Malem Hodar, one of the new districts for 2010, IRS was an income-generating activity for youths. IRS greatly contributed to the drop of unemployment in the health district when youths and others were hired to work for the project. . According to most spray operators questioned, this activity enabled youths to socialize and thus to strengthen their relationships in the various villages.. Many are farmers and in this pre-rain period, the money they earned in the IRS campaign enabled them to buy crop seeds.

Beneficiary populations in Malem Hodar much appreciated this free IRS service for which they were grateful to all the program’s partners.



*Malem Hodar spray operators after work
Photo: RTI/N. Gning*

During the 2010 IRS campaign, a satisfaction survey was conducted among a sample of beneficiaries in some areas in the district of Vélingara.

In the neighborhood of Sinthiang Aïdara, in the Commune of Vélingara, the head of the area was involved in the IEC mobilization and showed extraordinarily strong commitment to supporting the implementation of spraying activities. He insisted on raising his population's awareness and supervising the progress of spray teams. He said, "I'm the first concerned as a local responsible person and malaria has greatly declined in the neighborhood because of IRS."



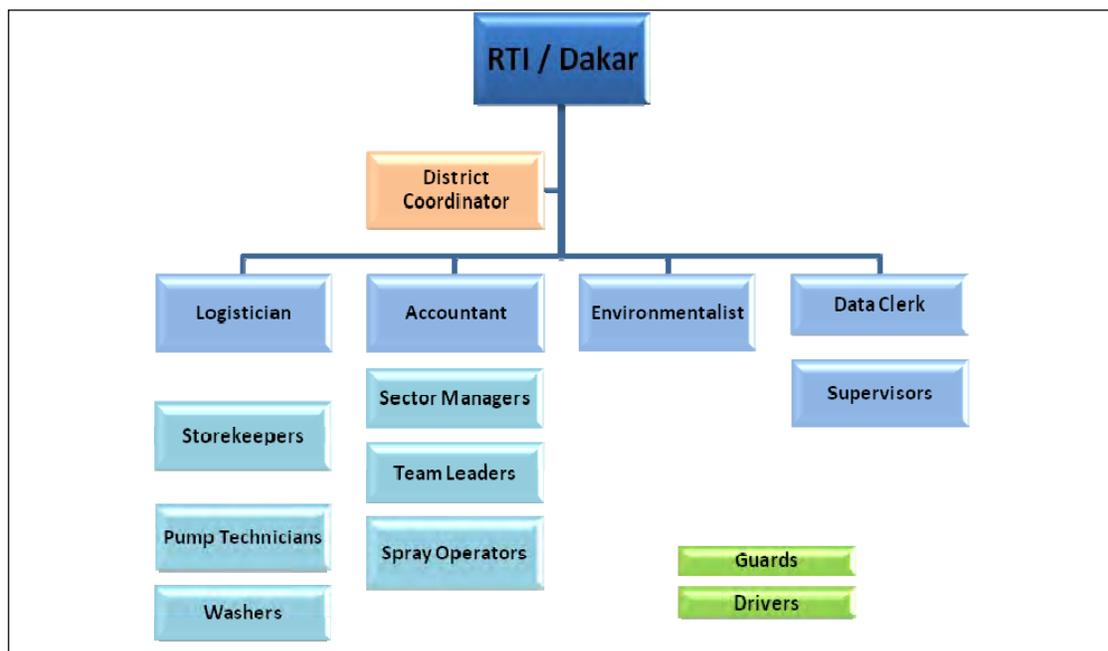
*The head of Sinthiang Aïdara neighborhood discussing
with supervisors*
Photo: RTI/F. Gueye



*Women involved in IRS sensitization in Sinthiang
Oulata*
Photo: RTI/F. Gueye

In the neighborhood of Sinthiang Oulata, still in the Commune of Vélingara, women were very involved in sensitizing target populations. Mrs. Diaite expressed her satisfaction with IRS. According to her, "It is very important to involve women in this kind of activity as they are concerned at the front lines." She added that "IRS is beneficial in many respects. Besides malaria control, it helps to get rid of insect pests and dangerous rodents."

Appendix A: Organization Chart



Appendix B: Warehouse Reconciliation Report

Item	Previous Stock	Qty sent to Districts	Final Stock Post Spray	Comments
K-Othrine	90,000	90,000	21,429	5,000 Sachets to IRS Mali & 10 to NRO
ICON WP	5,301	5,301	0	Totally used
ICON CS	14,323	14,323	0	Totally used
Pump	778	745	778	10 damaged
Rubber boots	1,276	1,276	1,276	
Coveralls	2,350	2,208	2,350	
Pregnancy test kits	316	316	0	
Hard hats	1,093	1,054	1,093	
Fire extinguishers	52	43	52	
Thermometers	49	49	49	
Buckets	680	680	680	
Plastic sheets	22,800m	11,124m	11,676m	
Aprons	330	145	330	
Neck covers	2,248	1,852	2,248	
Laptops DELL	15 sets	12 sets	15 sets	1 with battery default
Laptops IBM LENOVO	13 sets	6 sets	13 sets	7 to be sent for repair
Mobile phones	7	7	7	
Digital cameras	8	6	8	
Camcorder	1	1	1	
Generators	31	29	31	3 for repair
Printers	8	8	8	
Telephone handsets	18	18	18	
Modems	6	6	6	
T-Shirts	2,938	2,768	0	

Appendix C: Environmental Compliance Actions Table

Period	Key Issues	Recommendations	Actions Taken	Comments
Pre-spray	1. Soak pit areas	Soak pit areas need to be properly leveled	Soak pit areas were properly leveled with smaller stones to make it easy to work and walk on the surface.	
	2. Wash areas	New bath shelters and toilets for males and females need to be constructed in separate areas.		In future spray rounds
	3. Storage facilities	Provide additional fire equipment such as sand buckets and a shovel every in storage facility	Provided.	
	4. Bath shelters	Some fencing used for bath shelters were more transparent and needed to be aligned with plastic material.	Immediately done.	
Mid-spray	1. Use of PPE	One storekeeper and one driver's assistant needed PPE	Immediately provided for the storekeeper	More supervision will be required in future
	2. Monitoring and tracking of insecticides	None		
Post-spray	1. Waste disposal	Diourbel incinerator was identified by the Compliance Officer and recommended for use. Plastic containers recycling was also approved	Approval by DEEC of the processes of solid wastes incineration at Diourbel Hospital and recycling of plastic containers at PROPLAST manufactory	