



## **President's Malaria Initiative Support for Indoor Residual Spraying**

AFM reviewed the US President's Malaria Initiative (PMI) Fiscal Year 2008 Malaria Operational Plans available at <http://fightingmalaria.gov/countries/mops.html> to assess support for indoor residual spraying (IRS) in each of the 15 PMI countries. Below is a summary of the reports. The percent of the population targeted that are at risk was calculated from the population at risk and the population targeted provided in the reports. A list of acronyms is available at the end of this document.

### ***Fiscal Year 2008 PMI Countries***

<b>Benin</b>	
<b>Population Targeted</b>	350,000 people (4% of population at risk)
<b>IRS Budget</b>	\$1.22 million (9% of FY08 PMI budget)
<b>Insecticide(s) Used</b>	To be determined
<b>IRS Operational Research</b>	Effect of insecticide resistance on impact and efficacy of IRS/insecticide-treated nets (ITNs)

The PMI plans to support the implementation of IRS in Benin in Year 1 by targeting 70,000 households, which cover approximately 4% of the total population at risk for malaria (350,000 of an estimated 8.3 million people). One round of spraying along with community education on spraying will take place in several communes throughout the Oueme Department of South Benin. Year 1 IRS activities will be closely monitored to determine the best way to expand coverage in subsequent years. The proposed PMI funding for Year 1 is \$14 million, of which 9% or \$1,220,000 will go toward IRS.

There is evidence of vector resistance to pyrethroid insecticides in Benin, the impact of which is still unknown. As a result, one of the proposed PMI activities is to assess the effect of pyrethroid resistance on the efficacy of ITNs and IRS through clinical trials and experimental hut trials. Additional IRS activities include training of National Malaria Control Program (NMCP) staff in entomology and vector control; performance of an initial entomological evaluation to determine appropriate areas to carry out IRS; support of the existing national vector resistance surveillance program to include resistance monitoring of DDT, organophosphates and carbamates; and a technical assistance visit from the Centers for Disease Control and Prevention (CDC) to monitor planning and implementation of vector control activities.

<b>Ethiopia (Oromia Region)</b>	
<b>Population Targeted</b>	500,000 people (3% of population at risk)
<b>IRS Budget</b>	\$3,875,000 (19% of FY08 PMI budget)
<b>Insecticide(s) Used</b>	DDT and malathion
<b>IRS Operational Research</b>	Not available (N/A)

The Oromia Region of Ethiopia will be added to the PMI in 2008. Ethiopia was one of three African countries in the 1950s to base its malaria eradication program on IRS. Approximately 3% of the estimated 17.3 million people at risk for malaria in the Oromia Region are being targeted by the PMI for spraying in Year 1 (100,000 households, benefiting approximately 500,000 residents). Currently, DDT is the insecticide of choice for IRS in Oromia. Malathion is used for spraying in areas of Ethiopia where DDT resistance has developed. The proposed PMI funding for Year 1 is \$20 million, of which 19% or \$3,875,000 will go toward IRS.

Although Ethiopia's NMCP is extensive, it is in need of support from the PMI for activities such as procurement of additional IRS equipment; assistance in planning, implementing and evaluating IRS in Oromia; improving entomological capacity and monitoring; and improving the safe formulation, use and disposal of DDT.

<b>Ghana</b>	
<b>Population Targeted</b>	500,000 people (2% of population at risk)
<b>IRS Budget</b>	\$2,335,000 (14% of FY08 PMI budget)
<b>Insecticide(s) Used</b>	To be determined
<b>IRS Operational Research</b>	N/A

IRS activities in Ghana have been underway since 2004 by the AngloGold-Ashanti Mining Company with much success. The Ministry of Health and the NMCP plan to expand the program with PMI help targeting 100,000 households in Year 1, which would benefit approximately 500,000 residents or 2% of the estimated 23 million Ghanaians at risk for malaria. A Global Fund Round 7 grant proposal focusing on IRS was submitted by the NMCP and AngloGold Company. According to the Global Fund Round 7 Technical Review Panel Report, the proposal was given a Category 3 rating.

There is evidence of high resistance to DDT, bendiocarb and some synthetic pyrethroids in Ghana, making vector control a challenge. Proposed PMI activities for Year 1 include supporting the expansion of IRS; providing technical assistance; and supporting entomologic and insecticide resistance monitoring. The proposed PMI funding for Year 1 is \$17 million, of which 14% or \$2,335,000 will go toward IRS.

<b>Kenya</b>	
<b>Population Targeted</b>	250,000 households (population targeted unknown)
<b>IRS Budget</b>	\$4,050,000 (20% of FY08 PMI budget)
<b>Insecticide(s) Used</b>	ICON, deltamethrin, bifenthrin
<b>IRS Operational Research</b>	N/A

IRS activities in Kenya are currently being carried out in 16 western highland districts with help from Global Fund Round 4 funding. The Kenyan NMCP has targeted one million households for spraying in 2008, covering approximately five million people or 22% of the 23 million people at risk for malaria. Year 1 PMI IRS activities have targeted 250,000 households in four districts (two of the previous districts and to two additional neighboring endemic districts). Three pyrethroid insecticides are currently approved for IRS in Kenya; however, pyrethroid resistance has been detected and as a result, the use of non-pyrethroid insecticides is being considered.

Proposed PMI Year 1 activities include providing technical assistance to the NMCP; supporting surveillance and monitoring of targeted districts; monitoring for insecticide resistance; evaluating the half-lives of non-pyrethroid insecticides; and evaluating integrated vector control with both IRS and ITNs in high and low transmission areas. The proposed PMI funding for Year 1 is \$20 million, of which 20% or \$4,050,000 will go toward IRS.

<b>Liberia</b>	
<b>Population Targeted</b>	125,000 people (3% of population at risk)
<b>IRS Budget</b>	\$562,500 (4% of FY08 PMI budget)
<b>Insecticide(s) Used</b>	DDT and pyrethroid insecticide
<b>IRS Operational Research</b>	N/A

Liberia has experience using DDT for IRS dating back to the malaria eradication campaign of the 1950s. During the past several years, small scale IRS activities have been carried out in IDP (internally displaced persons) and refugee camps benefiting approximately 150,000 people. Liberia's NMCP targeted 100% of all IDP camps, refugee camps and temporary shelters for spraying by 2008 and would now like to expand IRS activities to the general population. The proposed PMI funding for Year 1 is \$12.5 million, of which 4% or \$562,500 will go toward IRS.

The PMI has targeted 25,000 households in Monrovia for IRS in Year 1 benefiting approximately 125,000 people or 3% of the estimated 3.77 million Liberians at risk for malaria. Both DDT and selected pyrethroid insecticides will be used for this small scale spraying program, the results of which will determine the insecticide(s) that will be used for spraying in subsequent years. Additional proposed PMI activities include an IRS baseline assessment; procurement of IRS equipment and supplies; CDC technical assistance on vector control activities; capacity strengthening for entomological monitoring; and insecticide resistance monitoring.

<b>Madagascar</b>	
<b>Population Targeted</b>	1.25 million people (7% of population at risk)
<b>IRS Budget</b>	\$4,263,000 (25% of FY08 PMI budget)
<b>Insecticide(s) Used</b>	To be determined
<b>IRS Operational Research</b>	N/A

IRS activities in Madagascar have been ongoing in the Central Highlands since 1993 using DDT. In 2004, pyrethroids became the insecticide of choice as a result of international pressure and in an effort to slow insecticide resistance. Focal spraying campaigns in the Central Highlands have reached 95-98% of targets over the past several years. In 2005, the World Health Organization recommended a shift from focal spraying to blanket spraying using a combination of insecticides (DDT, carbamate and pyrethroid); however, the NMCP and Ministry of Health have yet to come to a decision on how to proceed. The NMCP has also suggested increasing the annual IRS budget in order to conduct spraying campaigns on the West Coast but this has also not been finalized.

In the past, IRS campaigns were fully funded through the CRESAN Project (World Bank); however, the project ended in May 2007 and no further funding is available. The PMI along with USAID/Madagascar will support the continuation of IRS in the Central Highlands by targeting 250,000 households per year for spraying. This is expected to benefit approximately 1.25 million people or 7% of the estimated 18 million people at risk for malaria. Additional proposed Year 1 activities include supporting the evaluation of Year 1 activities to determine future vector control strategies; strengthening entomologic capabilities of the NMCP; and implementing support for a long-term vector control strategy in the Central Highlands. The proposed PMI funding for Year 1 is \$17 million, of which 25% or \$4,263,000 will go toward IRS.

<b>Mali</b>	
<b>Population Targeted</b>	430,000 people (3% of population at risk)
<b>IRS Budget</b>	\$1,664,200 (approximately 11% of FY08 PMI budget)
<b>Insecticide(s) Used</b>	To be determined
<b>IRS Operational Research</b>	1) benefits of larvaciding water sources surrounding sprayed households 2) reducing/eliminating mosquitoes in 5-10 hamlets along the Niger River during the dry season and measuring mosquito activity in nearby villages during the rainy season

Limited spraying activities have been ongoing in the gold mine areas of Mali; however, the PMI plans to encourage mining companies to expand their activities to include surrounding villages. The PMI will support IRS activities in Year 1 by targeting approximately 86,000 households in the endemic districts of Bla and Koulikoror Cercle. This is expected to benefit approximately 430,000 Malians or 3% of the estimated 12.3 million people at risk for malaria. Mali has not approved the use of DDT for IRS due to evidence of decreased susceptibility in some districts.

Additional proposed PMI Year 1 activities include the reduction or removal of tariffs on insecticides for IRS and larvaciding; funding for operational research to determine the benefits of larvaciding in conjunction with IRS; funding for the expansion of IRS to 5-10 hamlets near the Niger River; and support of entomological monitoring. The results of Year 1 IRS activities will be used to determine the feasibility of continuing and expanding spraying in Mali in subsequent years. The proposed PMI funding for Year 1 is \$15 million, of which approximately 11% or \$1,664,200 will go toward IRS.

<b>Zambia</b>	
<b>Population Targeted</b>	700,000 households (population at risk unknown and population targeted unknown)
<b>IRS Budget</b>	\$4.5 million (30% of FY08 PMI budget)
<b>Insecticide(s) Used</b>	DDT, ICON and alpha-cypermethrin
<b>IRS Operational Research</b>	N/A

IRS has been ongoing in Zambia since 2003 with help from the Ministry of Health as a result of the successful spraying campaign implemented by the Konkola Copper Mines in 2002. In 2006/7, additional funding from USAID and the World Bank helped support IRS in 15 districts throughout Zambia targeting 700,000 households. The campaign achieved 85% coverage of targeted households. In Year 1, the PMI will support IRS activities in the previous 15 districts to include: procurement of supplies and equipment, training, monitoring and evaluation, behavior change communication for IRS, environmental assessment, entomologic monitoring, pesticide storage and waste disposal. Year 1 spraying activities will target 700,000 households. The insecticides used for spraying will be ICON, alpha-cypermethrin and DDT. In 2008/9, the NMCP would like to expand IRS to seven additional districts with support from other donors. The proposed PMI funding for Year 1 is \$15 million, of which 30% or \$4,500,000 will go toward IRS.

## *Fiscal Year 2007 PMI Countries*

<b>Malawi</b>	
<b>Population Targeted</b>	50,000 households (population at risk unknown and population targeted unknown)
<b>IRS Budget</b>	\$850,000 (5% of FY08 PMI budget)
<b>Insecticide(s) Used</b>	To be determined
<b>IRS Operational Research</b>	N/A

The African Development Bank supported two small-scale pilot spraying projects in Malawi using pyrethroids targeting 2,100 households to determine the feasibility and effectiveness of IRS. The results were positive. In Year 1, the PMI and the Dwangwa Sugar Estates supported one round of spraying in the Nkhotakota District covering 25,000 households benefiting approximately 125,000 residents. Year 2 PMI activities include a second round of IRS in the Nkhotakota District targeting 50,000 households. In addition, the PMI will support entomological and epidemiological surveys. Spraying has been carried out using ICON as the Malawi government does not currently recommend the use of DDT for IRS; however, alternative insecticides will be considered for 2008 as cost and resistance data become available. The results of Year 2 IRS activities will determine the requirements and feasibility of expanding and continuing spraying in Malawi. The proposed PMI funding for Year 2 is \$18 million, of which 5% or \$850,000 will go toward IRS.

<b>Mozambique</b>	
<b>Population Targeted</b>	1.88 million people (10% of population at risk)
<b>IRS Budget</b>	\$3,135,500 (16% of FY08 PMI budget)
<b>Insecticide(s) Used</b>	DDT and pyrethroids
<b>IRS Operational Research</b>	N/A

The Ministry of Health has supported limited IRS activities in Mozambique since the 1960's. Large-scale spraying in the Maputo province has been ongoing since 2000 with help from the Lubombo Spatial Development Initiative (LSDI). In 2006, LSDI expanded large-scale spraying to three districts in the Gaza province. As a result of LSDI's success with IRS, spraying began in the Zambezia province in 2005. IRS insecticide, equipment, and supplies were purchased and distributed with Global Fund, PMI FY06, and USAID FY06 support. Spraying activities in three districts of the Zambezia province began in September 2007 targeting 200,000 households benefiting approximately 795,000 residents. In addition, the PMI provided limited support of IRS activities in three other districts of Zambezia. According to the FY08 Malaria Operational Plan, greater than 85% of targeted households were sprayed in Year 1.

The NMCP has targeted eight districts in the Zambezia province for IRS. In Year 2, the PMI plans to fully support IRS activities in the previous six districts of the Zambezia province targeting approximately 471,000 households. This will cover an estimated 1.88 million people or 10% of the approximately 18 million people at risk for malaria. DDT is the insecticide of choice for spraying activities in Mozambique except in areas where DDT is not indicated - pyrethroids are used in these areas. Additional PMI Year 2 activities include support for the procurement of pyrethroid insecticides, equipment, and supplies; strengthening of entomological capacity; and technical support from the CDC. The proposed PMI funding for Year 2 is \$20 million, of which 16% or \$3,135,500 will go toward IRS.

<b>Rwanda</b>	
<b>Population Targeted</b>	1.9 million people (21% of population at risk)
<b>IRS Budget</b>	\$6.47 million (38% of FY08 PMI budget)
<b>Insecticide(s) Used</b>	ICON
<b>IRS Operational Research</b>	N/A

In Year 1, the PMI supported spraying activities in five districts in Rwanda benefiting approximately 1.39 million residents. In addition, the PMI provided technical assistance to improve the entomological capacity of the NMCP. In Year 2, the PMI plans to continue supporting IRS activities in the same five districts and if resources permit, expand the program to include two additional districts. These seven districts consist of approximately 365,000 households covering an estimated 1.9 million people. Spraying activities would benefit approximately 21% of the estimated 9.1 million people at risk for malaria in Rwanda.

ICON-CS or ICON-WP will be the insecticide used for IRS activities in Year 2. Additional Year 2 PMI activities include building the IRS planning and monitoring capacity of the NMCP; supporting the development of a national Integrated Vector Control Policy; supporting the capacity building of district teams; and supporting the capacity building of NMCP staff. The proposed PMI funding for Year 2 is \$17 million, of which 38% or \$6,470,000 will go toward IRS.

<b>Senegal</b>	
<b>Population Targeted</b>	680,000 people (6% of population at risk)
<b>IRS Budget</b>	\$3,075,000 (19% of FY08 PMI budget)
<b>Insecticide(s) Used</b>	Synthetic pyrethroids
<b>IRS Operational Research</b>	Longevity of different classes of insecticides

In Year 1, the PMI supported IRS in three districts in Senegal targeting 75,000 households benefiting more than 500,000 residents. According to the FY08 Malaria Operational Plan, as of September 2007, approximately 76,000 households had been sprayed covering an estimated 650,000 residents. 98% of households targeted in Year 1 were actually sprayed, the success of which may have been due to community mobilization efforts prior to the implementation of IRS.

In Year 2, the PMI will continue to support IRS in the same three districts in addition to a possible second round for areas of Richard Toll. Approximately 76,000 households will be targeted for spraying in Year 2 benefiting an estimated 680,000 residents or 6% of the 11.3 million people at risk for malaria in Senegal. Since DDT is not approved for IRS in Senegal, synthetic pyrethroids are the insecticide of choice. Support from the PMI is still needed to strengthen epidemiological and entomological monitoring even though Senegal has national entomology experts from several groups. Projected Year 2 PMI activities include supporting insecticide susceptibility testing; supporting insecticide longevity research; and technical assistance from the CDC for entomological monitoring. The results of the Year 1 and Year 2 IRS campaigns will be used to plan future spraying programs. The proposed PMI funding for Year 2 is \$16 million, of which 19% or \$3,075,000 will go toward IRS.

## *Fiscal Year 2006 PMI Countries*

<b>Angola</b>	
<b>Population Targeted</b>	Difficult to determine (see text below)
<b>IRS Budget</b>	\$2.15 million (11% of FY08 PMI budget)
<b>Insecticide(s) Used</b>	ICON-CS
<b>IRS Operational Research</b>	N/A

Angola was one of the first three PMI countries in 2006. In Year 2, 110,000 households were sprayed throughout the southern provinces of Huila, Cunene and Namibe, benefiting approximately 613,000 residents. According to the FY08 Malaria Operational Plan, more than 85% of households targeted for IRS in Year 2 were sprayed.

The proposed PMI funding for Year 3 is \$19 million, of which 11% or \$2,150,000 will go toward IRS. Year 3 IRS activities in Angola include the discontinuation of spraying in the Cunene and Namibe provinces due to the low levels of malaria transmission; the continuation of IRS in the Huila province; and the initiation of IRS in the Huambo province - a highly endemic area reporting the second highest number of malaria cases annually. The target for Year 3 IRS activities is difficult to determine. The FY08 Malaria Operational Plan includes the following values: 120,000 households benefiting 600,000-700,000 residents; 160,000 households (100,000 in Huila and 60,000 in Huambo); and 110,000 households. There are an estimated 13.6 million people at risk for malaria in Angola.

The Angolan Ministry of Health is evaluating the use of DDT for IRS along the Angolan-Namibian border. The Namibian NMCP is currently using DDT for IRS while the Angolan NMCP is using ICON-CS. Entomologic surveys were initiated to understand better the epidemiology and transmission of malaria throughout specific Angolan provinces. These will continue in 2008 to assist in determining the most appropriate and effective malaria control intervention(s) for these areas.

<b>Tanzania/Zanzibar</b>	
<b>Population Targeted</b>	Difficult to determine (see text below)
<b>IRS Budget</b>	\$6,695,000 (20% of FY08 PMI budget)
<b>Insecticide(s) Used</b>	ICON
<b>IRS Operational Research</b>	1) integration of IRS and ITNs 2) quantification of repellent and irritant actions of DDT and pyrethroid insecticides

Tanzania is entering its third year of PMI program funding. There are an estimated 36.7 million people at risk for malaria in Tanzania (35.6 million people on the mainland and 1.1 million people on Zanzibar). The PMI has supported one round of spraying on the mainland and three rounds of spraying on Zanzibar. ICON was the insecticide of choice for all three rounds of spraying on Zanzibar as well as spraying activities in Muleba. In Year 2, the PMI sprayed approximately 40,000 households in Muleba benefiting an estimate 200,000 residents. Both the mainland and Zanzibar's IRS plans are still in draft form. In Year 3, a total of \$3.97 million, \$2 million of which is unspent FY07 funding, will likely support a third IRS campaign in the Muleba district (42,000 households) and a second campaign in the Karagwe district (95,000 households) of Northwestern Tanzania. These areas are characterized by "seasonal, stable transmission." The NMCP is also considering spraying an additional 10,500 households on Mafia Island for a total of 147,500 households throughout these three districts. Elsewhere in the FY08 Malaria Operational Plan, the targeted number of households is listed as 120,000 for the mainland.

On Zanzibar, IRS campaigns were conducted on the two main islands of Unguja and Pemba: the first campaign was from July to September 2006, the second was from January to March 2007, and the third was from July to September 2007. IRS coverage (percent of households targeted for IRS actually sprayed) reached 96% in the first round (203,754 households) and 91% in the second round (196,978 households). Early indications are that the third campaign is achieving the same coverage as the previous two. In Year 2, approximately 200,000 households in Zanzibar were sprayed benefiting an estimated one million residents. In Year 3, the PMI will continue to support spraying on Zanzibar depending on epidemiological and entomological data. The PMI will dedicate \$1.5 million targeting approximately 200,000 households. The costs per household sprayed have been estimated at \$10 per household.

As DDT was de-registered in Tanzania, IRS will be conducted using ICON since re-registration can take up to two years. The PMI will also assist the mainland with the re-registration of DDT (\$150,000 budget) as well as continue to support behavior change communication activities promoting IRS. Total proposed PMI funding for Year 3 is \$34 million, of which 20% or \$6,695,000 will go toward IRS.

The NMCP in conjunction with the Ifakara Health Research and Development Centre plans to conduct operational research into the cost-effectiveness of integrated IRS and ITNs using experimental huts and extrapolations based on malaria transmission models. Further operational research will be conducted on the repellent and irritant modes of insecticides.

<b>Uganda</b>	
<b>Population Targeted</b>	Difficult to determine (see text below)
<b>IRS Budget</b>	\$8.52 million (39% of FY08 PMI budget)
<b>Insecticide(s) Used</b>	ICON-CS
<b>IRS Operational Research</b>	N/A

Uganda was one of the first three PMI countries. In Year 1, the PMI supported large-scale spraying in the Kabale district targeting 103,000 households. The campaign successfully achieved 98% coverage benefiting approximately 480,000 residents. As a result of Year 1's success, the PMI expanded IRS activities in Year 2 to include seven districts throughout Southwestern and Northern Uganda targeting 600,000 households. According to the FY08 Malaria Operational Plan, greater than 85% of targeted households were sprayed in Year 2, and to date, approximately 600,000 households total have been covered.

The strategy for Year 3 will be to conduct selective spraying in the three epidemic-prone districts of Kabale, Kanunugu, and Rukungiri and conduct blanket spraying throughout endemic districts and IDP camps. The PMI has targeted approximately 795,000 households throughout 13 districts. Elsewhere in the FY08 Malaria Operational Plan, the targeted number of households adds up to 813,000 throughout 14 districts.

ICON-WP is currently the insecticide of choice for IRS in Uganda; however, more cost-effective insecticides such as DDT and/or ICON-CS are also being considered. The Ministry of Health has obtained approval for the use of DDT from the National Environment Management Authority. The PMI has also contracted the Research Triangle Institute to prepare an IRS Supplemental Environmental Assessment for DDT use and if approved, the PMI will begin using DDT for IRS. ICON-CS will be used for IRS activities in Year 3 where DDT is not used. Additional proposed PMI activities for Year 3 include support of entomologic monitoring and evaluation, and support of information, education and communication as well as behavior change communication and community mobilization about IRS. The proposed PMI funding for Year 3 is \$22 million, of which 39% or \$8,520,000 will go toward IRS.

#### **Acronyms**

CDC	Centers for Disease Control and Prevention
IRS	Indoor Residual Spraying
ITNs	Insecticide-treated nets
IDP	Internally Displaced Persons
LSDI	Lubombo Spatial Development Initiative
NMCP	National Malaria Control Program
PMI	President's Malaria Initiative