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Indoor Residual Spraying (IRS 2) Task Order Four

**2013 ZIMBABWE END-OF-SPRAY
REPORT**

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Abt Associates Inc. | 4550 Montgomery Avenue | Suite 800 North
| Bethesda, Maryland 20814 | T. 301.347.5000 | F. 301.913.9061
| www.abtassociates.com



2013 ZIMBABWE END-OF-SPRAY REPORT

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ACRONYMS

AIRS	Africa Indoor Residual Spraying
BMP	Best Management Practices
CDC	Centers for Disease Control
COP	Chief of Party
ECA	Environmental Compliance Assistant
ECO	Environmental Compliance Officer
DEHO	District Environmental Health Officer
DDT	dichlorodiphenyltrichloroethane
DHIS2	District Health Information System 2
EHD	Environmental Health Directorate
EMA	Environmental Management Agency
FEFO	first-expiry first-out
IRS	Indoor Residual Spraying
ITN	Insecticide Treated Nets
M&E	Monitoring and Evaluation
MOHCC	Ministry of Health and Child Care
NHIS	National Health Information System
NIHR	National Institutes of Health Research
NMCP	National Malaria Control Programme
OAA	Outline of Agreed Activities
PCR	Polymerase chain reaction
PEHO	Provincial Environmental Health Officer
PMI	President's Malaria Initiative
PPE	Personal Protective Equipment
PSI	Population Services International
RTI	Research Triangle International
SEA	Supplemental Environmental Assessment
STTA	Short Term Technical Assistance
TET	Therapeutic Efficacy Testing
USAID	United States Agency for International Development

WHO	World Health Organization
ZIMRA	Zimbabwe Revenue Authority
ZRC	Zimbabwe Red Cross

EXECUTIVE SUMMARY

During the second year of the Africa Indoor Residual Spraying (AIRS) Zimbabwe project, staff worked to support the National Malaria Control Programme (NMCP)'s Indoor Residual Spraying (IRS) campaign in the 25 districts that sprayed with pyrethroid-class insecticides. Similar to the previous year, AIRS Zimbabwe focused on improving environmental compliance/safety of the IRS campaign, and completing entomological surveillance to help monitor vector behavior, density, and resistance to the insecticides used for IRS.

AIRS Zimbabwe was encouraged by the continuous interest of IRS stakeholders in environmental compliance during the 2013 IRS campaign, as AIRS Zimbabwe completed several trainings on environmental compliance/safety for national, provincial, and district IRS personnel, continued the development and building of soak pits in all pyrethroid spray areas, and is currently evaluating provincial incinerators for future IRS solid waste disposal.

Regarding entomological surveillance, AIRS Zimbabwe assisted the President's Malaria Initiative (PMI) with a national-level entomological surveillance training in June, 2013, and led trainings for provincial and district IRS staff and insectary managers. AIRS Zimbabwe is also currently working on finishing a variety of entomological surveillance activities, ranging from insecticide susceptibility testing and vector behavior data collection, to drafting an initial report following a sentinel site assessment it completed with the NMCP, provincial health offices, the National Institutes of Health Research (NIHR) and PMI. AIRS Zimbabwe has also helped with efforts to establish a susceptible colony of mosquitoes in Zimbabwe.

Other key achievements in support of the 2013 IRS campaign include:

- Supporting the NMCP in planning the 2013 IRS campaign;
- Procuring and distributing personal protective equipment (PPE) and spray pump spare parts for use in the 25 pyrethroid districts;
- Building 48 soak pits in the 25 pyrethroid districts to assure the rinsing of spray tanks, and washing of PPE can be completed in a contained area that allows for safe disposal of IRS liquid wastes;
- Supporting trainings to restart programs to fix and maintain spray pumps, and use a SMS-based system for IRS campaign data reporting.
- Using smartphones to assist with the supervision of IRS campaign activities, and note areas of strength and weakness concerning IRS implementation.

Table 1 below, provides a brief summary of the results of the 2013 IRS Campaign in the 25 districts that completed IRS with pyrethroid-class insecticides.

TABLE 1: 2013 IRS CAMPAIGN AT A GLANCE

Dates of IRS Campaign	October 1, 2013 - January 21, 2014
Number of districts supported by PMI and AIRS Zimbabwe:	25 districts Manicaland: Makoni, Buhera, Mutare, Mutasa, Nyanga, and Chimanimani Mashonaland Central: Guruve, Bindura, Mazowe, and Shamva Mashonaland West: Hurungwe, Chegutu, Zvimba, Makonde, Sanyati, and Mhondoro Ngezi Mashonaland East: Murehwa, Mutoko, and Goromonzi Masvingo: Bikita, Zaka, and Masvingo Matabeleland North: Nkay and Bubi Midlands: Kwekwe
Insecticide-Used	Pyrethroids
Number of structures sprayed in the 25 districts	622,299
Number of structures targeted in the 25 districts	685,946
2013 IRS campaign spray coverage (in the pyrethroid districts)	90.72%
Population protected by 2013 IRS campaign (in the pyrethroid districts)	1,431,643

I. INTRODUCTION

Under its Task Order Four contract with United States Agency for International Development (USAID), Abt Associates has assumed the role of lead implementing partner for PMI's Africa Indoor Residual Spraying project in Zimbabwe and 14 other sub-Saharan countries. In May, 2013, AIRS Zimbabwe began implementing activities from its 2013-2014 work plan, and developing a variety of initiatives to improve the capacity of the Zimbabwe NMCP to complete IRS. Following discussions between PMI and the NMCP, AIRS Zimbabwe was directed to support IRS programming in 25 districts in Manicaland, Mashonaland Central, Mashonaland East, Mashonaland West, Masvingo, Matabeleland North, and Midlands provinces that complete IRS with pyrethroid-class insecticides.

Outside of working with the NMCP, AIRS Zimbabwe also worked closely with the provincial and district health offices in the seven provinces, to support their implementation of the 2013 IRS campaigns, and the NIHR to complete entomological surveillance data collection regarding the 2013 IRS campaign. AIRS Zimbabwe was also requested to support procurement and distribution of PPE and spray pump spare parts for use in the 25 pyrethroid districts.

This report provides a description of the activities that AIRS Zimbabwe completed between May 1, 2013 to April 30, 2014 (the period of performance for the AIRS Zimbabwe work plan) to support the 2013 IRS campaign in Zimbabwe, key observations that AIRS Zimbabwe noted before, during and after the IRS campaign, and recommendations to help improve the future work of the AIRS Zimbabwe project as well as enhancing the effectiveness and efficiency of IRS programming in Zimbabwe. The report also provides the results of the 2013 IRS campaign in the 25 districts supported by PMI/AIRS Zimbabwe.

2. COUNTRY AND PROJECT BACKGROUND

2.1 BACKGROUND OF IRS IN ZIMBABWE

IRS has been implemented in Zimbabwe since the 1940s, with initial IRS programming through the 1970s, focusing on spraying “barrier” areas, or lower altitude areas that surround the agricultural intensive highlands (where malaria transmission is relatively low), and preventing malaria epidemics in the major population areas.¹ In the 1980s, IRS programming shifted to a larger national program with coverage extending to most of the country, in order to nationally reduce morbidity and mortality.² This continues to be the overarching policy of the IRS program in Zimbabwe. The NMCP’s National Strategic Plan for 2008-2013 (Extended to 2015), aimed to provide nearly universal access to malaria prevention and protection programming, including IRS, with 90% of the at-risk populations covered by IRS and Insecticide Treated Nets (ITNs) by 2013.³ Malaria prevention in Zimbabwe is noted for the high acceptance of IRS. The latest national strategic plan was approved by the MOHCC in April, 2014. The strategic plan covers malaria prevention plans and policies for 2015-2017.

In the 1990s, the NMCP switched the insecticide primarily used in IRS (dichlorodiphenyltrichloroethane (DDT)) to pyrethroid-class insecticides. However, a noted increase in malaria cases during the late 1990s led the NMCP to switch to using a mix of pyrethroids and DDT in its IRS activities. For the 2013 IRS campaign, the NMCP sprayed 25 districts with pyrethroid-class insecticides, and 22 districts were sprayed with DDT.

2.2 BACKGROUND OF PMI AND AIRS ZIMBABWE SUPPORT FOR IRS IN ZIMBABWE

In 2011, Zimbabwe was selected as a PMI project country. Since the Zimbabwean NMCP has several decades’ experience in organizing and implementing IRS campaigns throughout the country, PMI decided to focus its support to providing technical assistance to the NMCP, and helping the NMCP improve its capacity to complete IRS, particularly with regards to environmental compliance/safety, entomological surveillance, and improving IRS campaign management.

In 2012, during the first year of AIRS Zimbabwe, the project only supported IRS campaigns in the districts spraying with pyrethroids in Mashonaland East, Mashonaland West, and Manicaland provinces.

In 2013, PMI and the NMCP asked AIRS Zimbabwe to increase its scope of work, and to support all 25 districts that spray with pyrethroids throughout Zimbabwe. AIRS Zimbabwe continued its focus on improving environmental management/safety of the IRS campaigns, and completing entomological

¹ Musawenkosi L. Mabaso H. Sharp B. Lengeler C. “Historical review of malarial control in southern African with emphasis on the use of indoor residual house-spraying.” *Tropical Medicine and International Health*. August 2004. Vol. 9. No. 8. pgs. 846–856.

² Musawenkosi L et al. 2004.

³ Ministry of Health and Child Welfare (MOHCW) Zimbabwe. National Malaria Control Programme Strategy 2008-2013. pg. 24.

surveillance work. Other IRS areas that AIRS Zimbabwe supported during the 2013 IRS campaign included: assisting with trainings and support for monitoring and evaluation (M&E)/data collection; and also helping to develop IRS campaign management supervision forms, to allow the NMCP and IRS campaign staff to record their observations on how the IRS campaign is implemented.

AIRS Zimbabwe’s 12 month work plan (May 1, 2013-April 30, 2014) was approved on July 19, 2013.

2.2.1 HIRING OF IRS TECHNICAL OFFICER

Per discussions with the NMCP, AIRS Zimbabwe hired an IRS Technical Officer, seconded to the NMCP, to help manage and support the IRS campaigns in the pyrethroid districts. The seconded IRS Technical Officer worked directly out of the NMCP’s offices from September, 2013 through February, 2014 to directly support the IRS campaign and all post-IRS campaign activities.

Overall, AIRS Zimbabwe found having a staff member working directly with the NMCP allowed for the project to gain quick access to key information on the IRS campaign (such as data on spray coverage by the 2013 IRS campaign), and build an instant line of communication between the project and the NMCP, Ministry of Health and Child Care (MOHCC), and NIHR. The seconded IRS Technical Officer was also able to send out key communications to provincial and district health offices (on behalf of the NMCP) to ensure AIRS Zimbabwe staff had ready access to the spray areas, in order to complete various project activities.

2.3 BACKGROUND OF THE 2013 IRS CAMPAIGN

The 2013 IRS campaign was completed in Manicaland, Mashonaland Central, Mashonaland East, Mashonaland West, Masvingo, Matabeleland North, and Midlands provinces between October 1, 2013 and January 21, 2014. AIRS Zimbabwe did not provide support to the districts that sprayed with DDT during the 2013 IRS campaign, due to challenges with the NMCP in conducting a Supplemental Environmental Assessment (SEA) to cover IRS districts which use DDT.

However, exceptions were made with regards to AIRS Zimbabwe’s support for spray pump maintenance, level 2, and M&E trainings. During these trainings, IRS campaign staff from all spray areas were included since the trainings covered issues that applied to all spray areas (the same spray pumps were used in all spray areas, and the revived Frontline SMS system was used in all spray districts for data reporting), and the NMCP noted there could be problems with the implementation of the IRS campaign, if only IRS campaign staff from pyrethroid districts received these trainings. Also, since the level 2 trainings are for all IRS campaign staff working in a province (regardless if they sprayed only DDT or pyrethroid districts), the NMCP and provincial officials did not want to separate pyrethroid district staff out of the level 2 training presentations completed by AIRS Zimbabwe. Additionally, the NMCP and provincial staff found some of the areas covered by the AIRS Zimbabwe staff during the level 2 trainings (such as the correct use of PPE and securing insecticides during transport) were good information for all IRS campaign staff to learn.

TABLE 2: DISTRICTS SUPPORTED BY AIRS ZIMBABWE DURING THE 2013 IRS CAMPAIGN

Province	Number of Districts Completing IRS with Pyrethroids
Manicaland	Chimanimani, Mutare, Buhera, Mutasa, Makoni, and Nyanga (6 districts)
Mashonaland	Shamva, Bindura, Guruve, Mazowe

Province	Number of Districts Completing IRS with Pyrethroids
Central	(4 districts)
Mashonaland East	Goromonzi, Mutoko and Murewa (3 districts)
Mashonaland West	Hurungwe, Makonde, Zvimba, Chegutu, Sanyati, and Mhondoro Ngezi (6 districts)
Masvingo	Masvingo, Zaka, Bikita (3 districts)
Matabeleland North	Bubi and Nkayi (2 districts)
Midlands	Kwekwe (1 district)
Total	25 districts

2.3.1 INSECTICIDE SELECTION FOR THE 2013 IRS CAMPAIGN

For the 2013 IRS campaign, the NMCP's selection of insecticides was based on the following criteria developed by the National Vector Control Subcommittee:

- Districts with high endemicity for malaria, and long malaria-transmission seasons are sprayed with DDT;
- Districts with moderate malaria endemicity and shorter malaria transmission seasons are sprayed with pyrethroids;
- Additional issues considered when determining if districts were sprayed with pyrethroids included:
 - Areas with high cultivation of tobacco;
 - Insecticide susceptibility status of vector mosquitoes as noted in reports developed by AIRS Zimbabwe, the NMCP, and NIHR following the 2012 IRS campaign.

3. AIRS ZIMBABWE SUPPORT FOR PRE-IRS CAMPAIGN ACTIVITIES

3.1 SIGNING OF OUTLINE OF AGREED ACTIVITIES TO SUPPORT THE IRS CAMPAIGN

An Outline of Agreed Activities (OAA) was established between AIRS Zimbabwe and the NMCP, to establish the terms for AIRS Zimbabwe to complete its work to support the 2013 IRS campaign and the use of the PPE that AIRS Zimbabwe procured for the 2013 IRS campaign. Additionally, the OAA established the agreed upon roles and responsibilities of the AIRS Zimbabwe IRS Technical Officer that was seconded to the NMCP during the 2013 IRS campaign. The final version of the OAA was signed by AIRS Zimbabwe and the Permanent Secretary for the MOHCW in September, 2013. A copy of the OAA is found in the annex of this report.

3.2 PROVISION OF PPE TO SUPPORT THE 2013 IRS CAMPAIGN

In March 2013, AIRS Zimbabwe and the Global Fund met with the NMCP to discuss PPE and other IRS commodities that were needed for the 2013 IRS campaign. The list of necessary IRS commodities was extensive, which consequently led to AIRS Zimbabwe agreeing to focus on procuring spray pump spare parts, and key PPE materials (such as gloves, face masks, face shields and helmets). The Global Fund agreed to prioritize procuring other IRS commodities such as stretcher beds, tents and, rain coats.

Following the completion of initial drafts of the 2013 OAA, AIRS Zimbabwe began procuring PPE items in late July. Most of the PPE was procured through local vendors. However, spare parts for spray pumps, face shields, face shield brackets, and face masks were procured internationally, due to either lack of availability in Zimbabwe (spray pump spare parts), or quality issues with the equipment available in Zimbabwe.

It's key to note the internationally procured IRS equipment took more than four weeks to clear from customs (originally arrived in mid-August and cleared from customs on September 17, 2013), because the Zimbabwe Revenue Authority (ZIMRA) was insisting that AIRS Zimbabwe should pay importation duties. The equipment eventually was cleared from customs, after the NMCP and MOHCC contacted ZIMRA and asked for the release of the equipment because IRS campaign training sessions (particularly the spray pump maintenance and level 2 trainings which required spray pump spare parts for training purposes) were about to start, and there was need to begin moving IRS equipment to provincial and district store rooms in order to start IRS on time.

All procured items were delivered directly to the AIRS Zimbabwe office in Harare and were re-organized based on the number of PPE items needed per province. AIRS Zimbabwe organized the transport of PPE to each of the 25 pyrethroid districts. Upon delivery, the quantity of PPE received was reconciled by district health representatives, and noted in district health stock ledgers. In some districts, AIRS

Zimbabwe delivered too many PPE items, where upon these items were returned to AIRS Zimbabwe, and are in-stock at AIRS Zimbabwe's offices in Harare. Please view the annex, to note the quantity of PPE items distributed to each province.

3.2.1 GLOVES ISSUES

AIRS Zimbabwe was informed during the first week of spraying that the gloves procured by the project for use during the IRS campaign were inadequate, as they tore easily (especially around the thumb). The IRS campaign teams experiencing this issue were quick to borrow gloves from nearby health centers. AIRS Zimbabwe also went forward and procured thicker replacement gloves. The replacement gloves were distributed to all spray teams by October 17, 2013.

3.2.2 FACE SHIELD ISSUES

AIRS Zimbabwe was pleased to note that NMCP and IRS campaign officials were strictly enforcing the use of helmets during the IRS campaign. This is a strong safety improvement from previous years, when sun/long-brimmed floppy hats were commonly used by spray operators to protect their heads during spraying. Unfortunately, the NMCP did not originally inform AIRS Zimbabwe during the start of the IRS campaign that the brackets, needed to attach the face shields to the helmets, were either in short-supply. AIRS had procured a large number of brackets for face shields and helmets in 2012, however after discussions with the NMCP, it was noted that the brackets were not retrieved by all provincial IRS campaign managers following the 2012 IRS campaign. This led to some spray operators completing their initial work on the IRS campaign without face shields. To remedy this situation, AIRS Zimbabwe went ahead and procured 1,200 additional brackets, which were shipped to Zimbabwe and provided to the spray teams by mid-October.

3.2.3 PROGRESSIVE RINSE BARREL ISSUES

Unfortunately the forecasting for the procurement of progressive rinse barrels proved to be difficult. AIRS Zimbabwe was surprised to learn that it was necessary to procure progressive rinse barrels for all 25 districts supported by AIRS Zimbabwe, although AIRS Zimbabwe had already procured 119 progressive rinse barrels in 2012 for Manicaland, Mashonaland, East, and Mashonaland West. The NMCP noted that many of the barrels that were procured for the 2012 IRS campaign were not returned.

Additionally, AIRS Zimbabwe learned right before the start of the IRS campaigns in the pyrethroid districts of Matabeleland North, Midlands, and Masvingo provinces that the forecasted number of progressive rinse barrels that were needed was inaccurate, and additional progressive rinse barrels were needed. AIRS Zimbabwe went forward and procured the requested progressive rinse barrels for the three provinces (49 barrels), and was able to provide the progressive rinse barrels to the provinces, just before spraying began in the provinces' pyrethroid districts.

3.3 TRAININGS

To increase the technical capacity of local malaria stakeholders in Zimbabwe, AIRS Zimbabwe completed a variety of trainings regarding environmental compliance and entomological surveillance. Additionally, AIRS Zimbabwe supported NMCP-led trainings regarding the IRS campaign M&E system and spray pump repair, and worked with PMI to complete an entomological training. In total, 697 persons received training from AIRS Zimbabwe-led, or AIRS Zimbabwe supported trainings.

3.3.1 ENTOMOLOGICAL TRAININGS

3.3.1.1 SUPPORT FOR PMI-LED ZIMBABWE ENTOMOLOGICAL TRAINING

In June, 2013, AIRS Zimbabwe assisted two Centers for Disease Control (CDC) entomologists, Dr. Adelaine Chan and Dr. William Brogdon to, complete a PMI-led entomological training to build the capacity of the NMCP and other malaria partners to collect and analyze data on insecticide resistance, and other entomological indicators. The objective of the training was to equip the participants with knowledge and skills to conduct entomological surveillance as well as understand the significance of entomological surveillance data for future IRS campaign planning and decision-making. The training took place at the DeBeers Research Laboratory in Chiredzi, where 61 persons including staff from the NMCP, the NIHR, the provincial health offices, Triangle Sugar Estates (who complete spraying around their plantation in Masvingo province), and the malaria control office of the Zimbabwean Army. Additionally, two entomologists from the AIRS Angola project attended the training to help improve their skills and knowledge of entomological surveillance. Sessions completed during the training included:

- Techniques to measure mosquito resistance to insecticides (particularly the use of CDC bottle bioassays);
- Molecular analysis to identify mosquitoes and insecticide resistance, particularly:
 - Classifying the species of mosquito and identifying insecticide resistance mechanisms in mosquito genes;
 - Determining whether mosquitoes were infected with the malaria parasite;
 - Establishing whether mosquitoes received their blood meal from humans
- Best practices in managing an insectary, and for rearing a susceptible colony of adult mosquitoes for entomological surveillance testing.

After completing classroom-based training on entomological techniques, the CDC entomologists and AIRS Zimbabwe's Technical Director led hands-on sessions to assure the trainees gained experience on how to complete bioassays, record knockdown data, and analyze bioassay results. Trainees also gained hands-on experience regarding how to prepare a mosquito for molecular and polymerase chain reaction (PCR) analysis.

FIGURE I: TRAINING PARTICIPANTS COMPLETING THE PREPARATION OF MOSQUITO SPECIMENTS FOR MOLECULAR ANALYSIS DURING THE PMI-LED ENTOMOLOGICAL TRAINING, JUNE, 2013



3.3.1.2 AIRS-LED ENTOMOLOGICAL TRAINING

In addition to the PMI-led training, AIRS Zimbabwe's Technical Director led a capacity building training in July, regarding key techniques that Zimbabwean health staff (especially Insectary Managers) would need to complete for assuring quality entomological surveillance during the 2013 IRS campaign. The training was provided to 29 people, including all 16 of Zimbabwe's insectary managers, and several staff members from provincial and district health offices in the seven regions that AIRS Zimbabwe supported during the 2013 IRS campaign. The Technical Director covered best practices to raise adult mosquitoes for entomological surveillance, activities to assist with bioassay work (using World Health Organization (WHO) and CDC techniques), basic mosquito morphology, and methods to identify vector species and mosquito behavior.

3.3.2 FIRST-AID TRAINING FOR DRIVERS AND IRS SUPERVISORS

It was noted during the 2012 IRS campaign, that spray teams had limited knowledge of first aid or protocols to follow in case of chemical poisoning or injury during the implementation of an IRS campaign. In September 2013, AIRS Zimbabwe worked with the Zimbabwe Red Cross Society (ZRC) to conduct first-aid training for IRS campaign field officers and coordinators. It was intended for the IRS campaign field officers and coordinators to take the information gained from the training, and provide this information to spray operators and other IRS campaign personnel during level-3 trainings. Staff from AIRS Zimbabwe and the ZRC presented on the following topics:

- Principles of first aid, and interview techniques to help identify an injury or other health issue;
- Providing assistance to an injured person who has lost consciousness; suffers from chemical poisoning (including key signs to note when someone has suffered from chemical poisoning from a pyrethroid class insecticide); received a snake, dog, or insect bite; or received a burn (from fire or chemical exposure);
- How to recognize and respond to someone suffering from a respiratory system issue, such as asphyxia; cardiac arrest; muscle strains or joint dislocation; or a broken bone/fracture;

3.3.3 SPRAY PUMP REPAIR AND MAINTENANCE TRAINING

AIRS Zimbabwe worked with the NMCP to provide a spray pump repair and maintenance training in September, 2013. The training was developed, after AIRS Zimbabwe noted the majority of spray pumps in the NMCP's possession were in disrepair while completing post-spray evaluations following the 2012 IRS campaign. The NMCP had noted that it had not trained spray pump maintenance personnel in a number of years due to decreased IRS campaign funding, and consequently more spray pumps that were damaged during previous IRS campaigns were not being repaired. The training was only provided to spray personnel from the 25 districts that AIRS Zimbabwe supported during the 2013 IRS campaign. Overall, 54 people, mostly IRS coordinators, (who are tasked with repairing spray pumps) attended the training. The training included a significant amount of hands-on practice, with participants given spray pumps in various states of disrepair, and working with the trainers to fix the spray pumps.

The training was led by staff from the NMCP and provincial health offices, with the environmental compliance officer from AIRS Zimbabwe providing assistance. The following topics were covered during the training:

- Review of the components of the two spray pumps used for IRS in Zimbabwe (Hudson and Micron Air);
- Assuring correct spray pump calibration;
- Dismantling and assembling of spray pumps;

3.3.4 SUPPORT FOR M&E/DATA MANAGER TRAINING

During discussions with the NMCP following the 2012 IRS campaign, it was noted that the NMCP had significant issues gaining spray campaign data from the field, as the Frontline SMS system that was used during previous IRS campaigns for tabulating IRS campaign data and sending it to IRS campaign staff was not utilized. Unfortunately, the NMCP was unable to use the Frontline SMS system in 2012 due to decreases in IRS programming budgets, and a lack of available mobile phones.

AIRS Zimbabwe helped revive the use of the Frontline SMS system for the 2013 IRS campaign, and procured 45 mobile phones for the use of the 45 data managers, in the 25 districts supported by AIRS Zimbabwe. AIRS Zimbabwe also supported a three-day training during the first week of October that was facilitated by staff from the NMCP, National Health Information Systems (NHIS), and Research Triangle International (RTI) regarding the NMCP's M&E system for the 2013 IRS campaign, and the use of the Frontline SMS system for data reporting. The training reviewed the features of the Frontline SMS system, how to send data, schedules for submitting spray campaign data to the NMCP, and troubleshooting for the use of the Frontline system. The training also included a significant amount of practice time for the data managers to ensure they were comfortable using the Frontline SMS system. Please see section 6.1, "M&E System for the 2013 IRS Campaign, and Use of the Frontline SMS System" for more information.

3.4 SUPPORT FOR LEVELS 1 AND 2 TRAININGS

The NMCP invited AIRS Zimbabwe to participate in and support the Level 1 and Level 2 trainings for the 2013 IRS campaign. The Level 1 training focused on the roles of national-level health staff regarding the IRS campaign, and developed plans to organize and implement IRS. The Level 2 trainings took place in each province, and focused on the role of provincial and district-level health staff regarding the IRS campaign, specifically how the staff at the provincial and district level manage and implement the IRS

campaign. The provincial and district-level health staff attending the level 2 training, also become the trainers for the level 3 training (training for spray operators and other IRS campaign support personnel).

For the level 1 training that was completed in August, AIRS Zimbabwe's Chief of Party (COP), Environmental Compliance Officer (ECO), and Technical Director completed several short sessions for the 34 level 1 training participants (including staff from the MOHCC, NMCP, NIHR, Environmental Health Directorate (EHD), Triangle Sugar Estates, Southern Region Trading Company, Nets for Africa, Plan International, Population Services International (PSI), and the WHO). The session presentations included:

- Ideas to further incorporate environmental compliance in IRS programming (via the construction of soak pits, use of environmental compliance supervision checklists, completion of pre-IRS campaign environmental checklists, and increasing understanding of the Environmental Management Act);
- The importance of entomological surveillance for IRS campaign decision-making;
- Improving IRS campaign personnel safety via improved handling and disposal of IRS campaign wastes and secure transport and storage of insecticides.

The sessions conducted by AIRS Zimbabwe staff also provided an opportunity for AIRS Zimbabwe to outline the project's scope of work to support the 2013 IRS campaign.

AIRS Zimbabwe also participated in the level 2 trainings for Mashonaland Central, Mashonaland East, Midlands, and Manicaland provinces. The level 2 trainings provided an opportunity for AIRS staff to meet with provincial health leaders and determine sites for constructing new soak pits. AIRS Zimbabwe staff completed presentations on environmental compliance and entomological surveillance for the 192 level 2 training participants in the four provinces. The specific issues presented include:

- The scope of work of the project to support the 2013 IRS campaign;
- Improving Environmental compliance monitoring via the use of checklists and data gathering;
- The importance and correct use of PPE;
- The correct use of soak pits for liquid waste disposal and the proper technique for completing progressive rinsing;
- Safe and secure transport/storage of insecticides;
- Protocols for reacting to spray campaign injuries and insecticide poisoning.

3.5 INFORMATION, EDUCATION, AND COMMUNICATION SUPPORT

AIRS Zimbabwe provided support for the Information, Education, and Communication (IEC) activities for the 2013 IRS campaign. The specific support that AIRS Zimbabwe provided included:

- Printing 25,000 IRS campaign pamphlets in Shona and Ndebele
- Printing 10,000 IRS campaign promotion posters in Shona and Ndebele
- Working with other malaria partners and printing various promotional materials (including t-shirts, golf shirts, posters, banners, and bags) in support of World Malaria Day activities in Victoria Falls, to support the Zambia/Zimbabwe Trans-Border Initiative, and the Southern Africa Development Community Malaria Day Activities in Hurungwe.
- During AIRS Zimbabwe's IRS campaign monitoring, AIRS Zimbabwe spoke with various homeowners to determine if they were approached by the warners (mobilizers), and knew when their house would be sprayed, and how to prepare for their house for the spray campaign.

4. ENVIRONMENTAL COMPLIANCE ACTIVITIES

4.1 ENVIRONMENTAL COMPLIANCE TRAININGS

Building off the environmental compliance techniques which AIRS Zimbabwe introduced during the 2012 IRS campaign, AIRS Zimbabwe conducted a national level environmental compliance training in August, 2013, to further build environmental compliance/safety capacity among malaria stakeholders. The three-day training took place right before the national, provincial, and district-level IRS campaign planning/training sessions (levels 1, 2, and 3 trainings). The training provided an opportunity to review the results from the 2012 IRS campaign and areas of environmental compliance concern noted by AIRS Zimbabwe. AIRS Zimbabwe also explained its scope of work to support the 2013 IRS campaign, and reviewed some of the environmental compliance concepts that AIRS Zimbabwe introduced in 2012, specifically regarding liquid and solid waste disposal. Approximately 75 persons attended the training, including staff from NMCP, NIHR, Environmental Management Agency (EMA), EHD, provincial vector control field officers, and provincial and district health staff from the seven provinces that AIRS Zimbabwe supported for the 2013 campaign. AIRS Zimbabwe staff along with personnel from the EMA, the Provincial Environment Health Office (PEHO) of Mashonaland East, NMCP, MOHCC, and the NIHR led sessions on the following topics:

- Concepts of environmental compliance, with regards to safeguarding IRS campaign staff, and ensuring IRS campaigns leave as close to zero environmental impact in targeted spray areas as possible;
- International and national regulations regarding the use of insecticide for IRS campaigns, specifically the tenets of the Zimbabwean Environmental Management Act;
- National policies and guidelines regarding occupational health and safety for IRS campaign staff;
- The correct-use of PPE during IRS campaigns;
- Methods for ensuring safe transport and storage of insecticides;
- Techniques and protocol to be undertaken during a spill of insecticide, and in case of a chemical poisoning of IRS campaign personnel;
- National and international regulations regarding the transport and disposal of IRS campaign solid and liquid wastes;
- Use of progressive rinsing to clean PPE and spray pumps, and the use of a soak pit to dispose of the resulting liquid wastes;
- Descriptions of various different types of soak pits that can be constructed;
- Techniques and tools used for completing environmental compliance monitoring during an IRS campaign (AIRS Zimbabwe specifically presented on the AIRS project environmental compliance checklist that were being used in all project countries).

A practical session was completed during the third day of the training, where participants traveled to

Bindura district to inspect an IRS campaign store room using the environmental compliance supervision tools presented during the training, observe a soak pit under construction, and participate in a practice run of progressive rinsing.

At the end of the training session, staff from the NMCP, provincial and district health offices, EMA, and NIHR agreed to the following activities to improve environmental compliance during the 2013 IRS campaign:

- The national IRS campaign manual should be revised to incorporate environmental compliance;
- Environmental compliance should be incorporated into the levels 1, 2, and 3-level trainings;
- Soak pits should be built in all areas where pyrethroids would be sprayed, and monitoring systems should be set-up to ensure soak pits are safely degrading liquid wastes;
- All solid wastes generated during the IRS campaign should be kept at a secure place in each district, to ensure it can be found for safe incineration after the IRS campaign ends;
- An environmental compliance supervisory checklist (based on the AIRS Zimbabwe environmental compliance checklist from 2012) was adopted for provincial and district health staff to monitor environmental compliance aspects of the 2013 IRS campaign. The NMCP and provincial and district health staff chose this checklist, over the new checklists that AIRS developed for monitoring the 2013 IRS campaign, as the 2012 IRS campaign checklist was straightforward and brief, and readily understood. The NMCP also decided to standardize the use of the form (to allow for comparable data between the provinces and districts) across all spray areas, and thereby require all provinces and district officials to only use the checklist instead of other locally developed forms
- A pre-IRS campaign assessment should become standard, to note environmental compliance issues and hazards, and to identify any work that needs to be completed to ready soak pits and other IRS campaign infrastructure.

4.2 HIRING OF CONSULTANTS FOR ENVIRONMENTAL COMPLIANCE MONITORING

AIRS Zimbabwe hired three local consultants to help complete IRS environmental compliance monitoring in all 25 pyrethroid-districts. The consultants observed whether spraying during the 2013 IRS campaign met the guidelines listed in PMI's Best Management Practices (BMP). All three consultants that AIRS Zimbabwe hired had previous experience working on IRS in Zimbabwe, either via work with the NMCP, MOHCC, or provincial health offices. All three consultants had completed similar work during the 2012 IRS campaign for AIRS Zimbabwe. For the 2013 IRS campaign, AIRS Zimbabwe expanded the number of environmental compliance indicators collected, and trained the three local consultants on how to use smartphones to complete environmental compliance monitoring. One of the consultants, Mr. Naboth Mawoyo, also assisted AIRS Zimbabwe with its environmental compliance training, presenting on national environmental laws.

Using their expertise and contacts at the provincial level, the three consultants also played a key role in helping to organize and supervise the construction of new soak pits in all provinces. The three consultants were also involved in conducting the post IRS activities, including the quantification and collection of IRS solid waste for incineration, and helping to determine PPE and insecticide inventory.

4.3 PRE-SPRAY ENVIRONMENTAL INSPECTION

In September/October, before the 2013 IRS campaign began, the AIRS Zimbabwe ECO and Environmental Compliance Assistant (ECA), and the three consultants visited the proposed campsites and spray areas in the 25 pyrethroid districts. The visits provided an opportunity for AIRS Zimbabwe to note specific issues where assistance could be provided regarding environmental compliance for the 2013 IRS campaign. AIRS Zimbabwe used a pre-spray environmental compliance checklists that had been programmed into smartphones, for completing the pre-spray environmental compliance monitoring (please see section 5.4.1., “Use of Smartphones for IRS Campaign Monitoring”).

The pre-spray environmental compliance inspections were completed at provincial-level store rooms in Mashonaland Central, Mashonaland East, Mashonaland West, Manicaland, Masvingo, Matabeleland North, and Midlands, and at 24 district-level store rooms⁴, in addition to soak pit sites. Key findings from the pre-spray environmental compliance inspections, and actions taken by AIRS Zimbabwe to help improve the various issues noting during the inspections are found below in Table 3.

TABLE 3: KEY ISSUES NOTED DURING PRE-SPRAY ENVIRONMENTAL COMPLIANCE ASSESSMENTS AND ACTIONS TAKEN BY AIRS ZIMBABWE

Issue Noted During Pre-Spray Environmental Compliance Inspection	Action Taken by AIRS Zimbabwe to Remediate the Issue
<p>None of the store rooms (provincial- or district-level) visited had:</p> <ul style="list-style-type: none"> • Warning signs regarding toxicity of the insecticides within the store rooms; • Thermometers for measuring the temperature in the store rooms holding insecticides; • Fire extinguishers or spill clean-up kits; 	<p>AIRS Zimbabwe staff spoke to the PEHO and District Environmental Health Officers (DEHOs) about the risks of not having signs, thermometers, fire extinguishers, and spill kits.</p> <p>The PEHOS worked with health staff at the provincial and district-levels to improvise signage, and find and use spill kits provided during the 2012 IRS campaign (see figure 2, below this table).</p> <p>As of present, no action was taken regarding the fire extinguishers and thermometers.</p>
<p>Only two of the 24 district level store rooms visited, had a separate room for storing the insecticides and IRS campaign commodities. In all other store rooms insecticide and IRS commodities were mixed together with various health commodities and pharmaceuticals. Additionally insecticides were not stored on pallets or shelves, but usually left on the ground.</p>	<p>The NMCP, PEHOs, DEHOs and IRS coordinators were made aware of these observations.</p> <p>In Hurungwe district, after receiving this information, the insecticides and IRS materials were moved to a separate store room.</p> <p>District staff in Murewa also moved their insecticide and IRS materials (see box below) to another area.</p> <p>AIRS Zimbabwe met with PEHOs, and advised them to separate IRS commodities from non-IRS commodities. The PEHOs noted they will need to look into a long-term solution for this issue for</p>

⁴ Since Kadoma district was split into Sanyati and Mhondoro Ngezi districts in 2013, the new districts are continuing to use the same district store room at present.

Issue Noted During Pre-Spray Environmental Compliance Inspection	Action Taken by AIRS Zimbabwe to Remediate the Issue
	future IRS campaigns.
The store room holding insecticides in Murewa district was located next to the hospital kitchen. Not only was this a potential issue for the food being prepared at the health center, but rodents were also found in the store room.	After learning of this information, the DEHO moved the insecticide and IRS materials to an empty and disused hospital ward.
In Buhera and Mutare districts, insecticides were being stored in hospital wards. This could pose a risk given the flammability and toxicity of insecticides.	AIRS Zimbabwe met with hospital and district officials and advised them to move insecticides to a new store room, as soon as possible.
The provincial store room in Marondera (Mashonaland West) and Bindura (Mashonaland Central) were noted for their poor ventilation (via small air ducts) and few windows.	AIRS Zimbabwe spoke to the PEHOs about the situation, and they agreed to look for a long-term solution.
Soak pits constructed in 2012 in Mutoko, Chegutu, Murewa, Chimanimani, Hurungwe, and Mutare districts were found to be in need of gates, warning signs, and in need of some repairs for cracks on the progressive rinsing slabs.	AIRS Zimbabwe hired masons and other personnel to make repairs to the soak pits and build gates and fencing. Additionally, district personnel provided new warning signs.

FIGURE 2: EXAMPLE OF IMPROVISED CHEMICAL WARNING SIGNS AT MAZOWE DISTRICT STORE ROOM



4.4 BUILDING OF SOAK PITS

As agreed with the NMCP and provincial health offices, AIRS Zimbabwe built 48 new soak pits at the proposed camp site areas in the 25 pyrethroid districts. Construction of soak pits began in August in Bindura district.

In the pyrethroid spray areas of Mashonaland East, Mashonaland West, and Manicaland provinces, 65 soak pits had already been built by AIRS Zimbabwe during the 2012 IRS campaign. As noted in section 4.3. “Pre-Spray Environmental Inspection”, AIRS Zimbabwe inspected these soak pits and hired masons to refurbish the soak pits to assure they were ready for use before the start of the 2013 IRS campaign. Cumulatively, the AIRS Zimbabwe Project has constructed 113 soak pits over the past two years. Table 4 below notes the number of soak pits built by AIRS Zimbabwe in support of the 2012 and 2013 IRS campaigns.

TABLE 4: NUMBER OF SOAK PITS BUILT PER DISTRICT BY AIRS ZIMBABWE

Province	District	Number of Soak Pits Built in 2013	Number of Soak Pits Built in 2012	Total Number of Soak Pits Built by AIRS Zimbabwe	Notes
Manicaland	Mutare	1	4	5	
	Makoni	2	3	5	
	Nyanga	2	5	7	
	Buhera	0	3	3	
	Chipinga	0	4	4	
	Mutasa	0	4	4	
	Chimanimani	0	4	4	
Mashonaland Central	Shamva	5	AIRS Zimbabwe did not support Mashonaland Central during the 2012 IRS campaign	5	
	Bindura	4		4	
	Guruve	4		4	
	Mazowe	4	4		
Mashonaland East	Murewa	1	4	5	
	Goromonzi	1	0	1	
	Mutoko	0	5	5	
	Mudzi	0	4	4	This is a DDT district, no longer supported by PMI/AIRS
	UMP	0	3	3	This is a DDT district, no longer supported by PMI/AIRS
Mashonaland West	Chegututu	1	1	2	
	Makonde	1	4	5	

Province	District	Number of Soak Pits Built in 2013	Number of Soak Pits Built in 2012	Total Number of Soak Pits Built by AIRS Zimbabwe	Notes
	Hurungwe	0	8	8	
	Kadoma/ Sanyati/ Mhondoro- Ngezi		4	4	
	Zvimba	0	2	2	
	Kariba	0	3	3	This is a DDT district, no longer supported by PMI/AIRS
Masvingo	Masvingo	3	AIRS Zimbabwe did not support Masvingo during the 2012 IRS campaign	3	
	Bikita	4		4	
	Zaka	5		5	
Matabeleland North	Bubi	2	AIRS Zimbabwe did not support Matabeleland North during the 2012 IRS campaign	2	
	Nkayi	2		2	
Midlands	Kwekwe	6	AIRS Zimbabwe did not support Midlands during the 2012 IRS campaign	6	
Totals		48	65	113	

As a result of the AIRS Zimbabwe environmental compliance training (including the presentations made during levels 1 and 2 training), many IRS officials took a principle role in conducting follow-ups with the masons, in place of the AIRS Zimbabwe team, to assure the soak pits were constructed properly and ready for use before the beginning of the 2013 IRS campaign.

4.5 INCINERATOR EVALUATIONS

4.5.1 INCINERATOR EVALUATION VIA ENGINEERING FIRM FOR MANICALAND, MASHONALAND EAST, AND MASHONALAND WEST PROVINCIAL INCINERATORS

Following up on the incinerator evaluations completed by AIRS Zimbabwe after the 2012 IRS campaign (where the provincial incinerators in Manicaland, Mashonaland East, and Mashonaland West were found to be unsuitable for IRS campaign solid waste disposal), AIRS Zimbabwe began working to subcontract an engineering firm to assess these three provincial incinerators, and develop a report to describe the current condition of the incinerators, and outline how the incinerators could be refurbished to meet PMI, WHO, and national standards for incinerating IRS solid wastes safely. AIRS Zimbabwe intended to contract the engineering firm and gain their report in August/September, 2013, in order to refurbish the incinerators before the start of the 2013 IRS campaign. However, gaining stakeholder buy-in for the activity (chiefly from the NMCP, Provincial Health Offices, EMA, MOHCC's Hospital Planning and Project Management Unit, and the Ministry of Local Government, Public Works, and National Housing's Department of Public Works) has taken considerable time.

Initial meetings were held with the various stakeholders from August to October to gain more details about the incinerators, and gain feedback regarding the criteria for the incinerator evaluations to be completed by the engineering firm. A final criterion was agreed upon by all stakeholders in December, 2013. A final review meeting was completed on March 7, where all stakeholders agreed on their preferred engineering firm.

AIRS Zimbabwe is in the process of working with the preferred engineering firm to finalize their budget, in order to award the incinerator evaluation subcontract. It is expected that the engineering firm will complete its assessment of the Manicaland, Mashonaland East, and Mashonaland West provincial incinerators and produce their report in May, 2014.

4.5.2 AIRS ZIMBABWE PRELIMINARY INCINERATOR EVALUATION

AIRS Zimbabwe also completed a brief preliminary evaluation of the provincial incinerators in Mashonaland Central, Masvingo, Matabeleland North, Matabeleland South, and Midlands provinces. The evaluation used the same checklist and criteria as preliminary incinerator evaluation that AIRS Zimbabwe completed in Manicaland, Mashonaland East and Mashonaland West provinces, during the 2012 IRS campaign. The AIRS Zimbabwe ECO and ECA completed the incinerator evaluations with each province's PEHO and engineers from the provincial Public Works Department, and staff from the EHD and NMCP. Overall, it was noted that the five provincial incinerators evaluated are all in poor condition, and none of them are adequate for safely disposing of IRS campaign solid wastes. The key results from the review of the five provincial incinerators is found below in table 5.

TABLE 5: SUMMARY OF INCINERATOR ASSESSMENT DATA

Province	Incinerator	Type of Incinerator	Maximum Temperature the Incinerator can Reach	Other Issues
Mashonaland Central	Mt Darwin Hospital	Coal-Fired	Unknown, not measured recently	<ul style="list-style-type: none">• The external chambers were rusty and damaged, and are unlikely to hold the proper temperature for incineration• The internal brick lining of the refractory was

Province	Incinerator	Type of Incinerator	Maximum Temperature the Incinerator can Reach	Other Issues
				<p>cracked and falling apart.</p> <ul style="list-style-type: none"> • The chimney was rusty and partially collapsed. • The stocker feeder was rusty and damaged, and did not allow easy access to the incinerator. • The blower was rusty and damaged. • The incinerator lacks an ash pit • The plant attendants are not provided with adequate PPE • The personnel operating the incinerators were not trained in correct procedures of handling biological hazardous materials, and the maintenance and operations of the incinerator.
Matebeleland North	St Lukes Provincial Hospital	Wood Fired	Not known, or recently tested.	<ul style="list-style-type: none"> • The incinerator is fired by fire wood, and creates considerable pollution • The incinerator is of medium scale and beehive shaped (thereby its sides are open), and therefore has a lower capacity than most incinerators. Only able to process around 50kgs per hour. • There is no roof over the incinerator. It was blown away during a storm, and the incinerator cannot be used when it rains. • The top cover of the incinerator chamber is damaged and does not close properly. • The incinerator lacks an ash pit. • The kiln has several cracks. • The incinerator lacks a safety/maintenance plan. • Stack (chimney) height is less than 10 meters, risking air pollution to the surrounding community. <p>The incinerator lacks equipment to measure emissions.</p> <ul style="list-style-type: none"> • The personnel operating the incinerators were not trained in correct procedures of handling biological hazards, and the maintenance and operations of the incinerator. The plant attendants are not provided with adequate PPE (only had overalls and gloves in stock which were not suitable for incineration work)
Masvingo	Masvingo Provincial Hospital Incinerator	Coal fired	Not Known	<ul style="list-style-type: none"> • The incinerator lacks a blower fan and temperature control mechanism • There is a damaged grate resulting in waste being received at the ash tray before being incinerated. • Roof over incinerator leaks • PPE for incinerator workers in poor condition, need to be replaced • No regular collection of waste residue • Refuse ash was heaped near the incinerator office • The incinerator lacks a control-board
Matebeleland South	Gwanda Provincial Hospital	Coal-Fired	Not Known	<ul style="list-style-type: none"> • The incinerator has reportedly not worked for several years. • Since the hospital lacks an incinerator, they

Province	Incinerator	Type of Incinerator	Maximum Temperature the Incinerator can Reach	Other Issues
				<p>normally complete open-air burning of medical waste.</p> <ul style="list-style-type: none"> ● The fire clay gasket in the incinerator has fallen out of place leading to the incinerator possibly creating a lot of smoke ● Additionally, several brick walls on the incinerator were in very poor condition ● The incinerator room is covered with soot, a sign of incomplete combustion ● The incinerator was condemned in 2009 by the Public Works department, as the bricks in the incinerator had worn away, and the external casing was rusted through. ● The incinerator lacks an ash pit and all the ashes from the incinerator are heaped just outside the incinerator area ● The doors for the primary and secondary chambers are no longer closing properly, which would lead to smoke from the chambers escaping through the door and fill the incinerator room ● The plant attendants are not provided with adequate PPE ● The personnel operating the incinerators were not trained in correct procedures of handling biological hazards, and the maintenance and operations of the incinerator. The plant attendants are not provided with adequate PPE (only had overalls and gloves in stock which were not suitable for incineration work)
Midlands	Gweru Provincial Hospital	Diesel Fired	Unknown, not measured recently	<ul style="list-style-type: none"> ● The incinerator is no longer reaching the designed temperatures of about 2000C ● Using a temperature gauge, it was noted the incinerator can only reach 120C resulting in incomplete combustion of hospital waste ● . The secondary burner is no longer working. ● All blowers (primary and secondary) are currently not working. ● The incinerator lacks an ash pit, and lacks a safe area to dispose of incinerator ashes ● The plant attendants are not provided with adequate PPE ● The personnel operating the incinerators were not trained in correct procedures of handling biological hazards, and the maintenance and operations of the incinerator. The plant attendants are not provided with adequate PPE (only had overalls and gloves in stock which were not suitable for incineration work)

4.6 INCINERATION AND SOLID WASTE DISPOSAL

Since the current provincial incinerators have a variety of issues which prevent them from safely disposing of IRS campaign solid wastes, AIRS Zimbabwe worked with the NMCP and provincial health offices to dispose the IRS campaign solid wastes for the 25 pyrethroid districts at an adequate private-sector incinerator. The provincial health offices did a good job of gathering the solid wastes after the 2013 IRS campaign at central storage areas, and worked with AIRS Zimbabwe to develop a schedule for the transport and completion of the solid waste incineration. Solid waste incineration began on February 25, when solid wastes from Mashonaland Central and Mashonaland West were collected and delivered to the Bromar and Bytes International Plant in Harare. Regrettably, after completing the incineration of the solid wastes from Mashonaland Central and Mashonaland West, the Bromar and Bytes International Plant's incinerator's temperature gauge began to malfunction, and the plant's staff could not accurately determine the temperature within the incinerator. Since the temperature gauge repairs were expected to take some time, after conferring with the NMCP and provincial health offices, a decision was made to stop incineration at the Bromar and Bytes International Plant on February 27, 2014, and find another incinerator to use.

The AIRS Zimbabwe ECO, with the assistance of the Midlands Provincial Field Officer, Principal Environmental Health Technician, and the Midlands provincial health office was able to visit and identify the Zimasco incinerator as an alternative incinerator. After visiting the incinerator, AIRS Zimbabwe, the NMCP, and provincial health offices decided to use this incinerator due to:

- Its location in Midlands, means it is centrally located for most spray areas, and will minimize costs and time for transport;
- The incinerator is powered by its own generator, and has extensive capacity to complete the remaining incineration of the IRS campaign in two days;
- The incinerator is able to reach 1,600 degrees, which is greater than the 1,100 degrees minimum temperature that an incinerator must reach to dispose of pyrethroid solid wastes;
- The stack/chimney for the incinerator is 50 meters tall, and should provide enough clearance for the incinerator's smoke to safely disperse in the atmosphere;

The incineration of the solid wastes from the remaining provinces was completed on April 9-10. Since this is a new incinerator, used for solid wastes, AIRS Zimbabwe and Zimasco's health and safety department completed a short training on April 9th, 2014, to go over standards and procedures for safely disposing of IRS solid waste. Additionally, AIRS Zimbabwe procured a small quantity of PPE (boots, face masks, helmets, safety goggles, and ear plugs) to ensure MOHCC workers are properly equipped for helping to load the solid wastes into the incinerator⁵, and to monitor the solid waste incineration. Zimasco also agreed to measure the temperature of its incinerator using a pyrometer, to ensure the incineration was completed at the correct temperature. The incineration was observed by the AIRS Zimbabwe ECO, EMA Midlands, staff from the EHD, and the Midlands PEHO. Finally, Zimasco has issued a certificate of incineration, noting the district of origin, type of solid waste incinerated, and temperatures of the incinerator, to confirm the incineration was completed correctly.

Table 6, below provides details about the solid waste that was incinerated from the 25 pyrethroid districts.

⁵ At the Bromar and Bytes International Plant, the incineration staff did not require any assistance with incineration, therefore AIRS Zimbabwe did not procure any PPE for the MOHCC officials who were present for the incineration of solid wastes from Mashonaland West and Mashonaland Central.

TABLE 6: SUMMARY OF 2013 IRS CAMPAIGN SOLID WASTE ITEMS INCINERATED

Province	District	Quantity of waste incinerated in kg	Materials Incinerated	Notes	Date of Incineration
Mashonaland West	Sanyati	71	Empty Sachets, empty boxes, used mutton cloth and used face masks.	Incinerated at Bromar and Bytes Plant in Harare	February 25, 2014
	Mhondoro-Ngezi	72			
	Makonde and Zvimba	76			
	Chegutu	38			
Mashonaland East	Hurungwe	88			April 9-10, 2014
	Murewa	155			
	Mutoko	140			
	Goromonzi	65			
Manicaland	Mutasa	153			April 9-10, 2014
	Mutare	170			
	Chimanimani	100			
	Buhera	139			
	Makoni	99			
Mashonaland Central	Nyanga	161		Incinerated at Bromar and Bytes Plant in Harare	February 25, 2014
	Bindura	27			
	Shamva	32			
	Mazoe	72			
Midlands	Guruve	33		April 9-10, 2014	
	Kwekwe	79			
Masvingo	Masvingo	54		April 9-10, 2014	
	Bikita	62			
	Zaka	55			
Matebeleland North	Bubi	43		April 9-10, 2014	
	Nkayi	45			
Total		2,029 kgs			

5. OBSERVATIONS OF 2013 IRS CAMPAIGN

5.1 ORGANIZATION OF THE 2013 IRS CAMPAIGN

The 2013 IRS campaign was implemented from October 1, 2013 through January 21, 2014, with spray teams deployed to work continuously for 21 days during three sessions (roughly one month). Between each session the spray operators were provided a one week break. The spray operators were community members that came from the spray area, and have familiarity with the communities targeted for spraying. The spray operators were divided into 37 spray teams. Each team had five field supervisors (ratio of three spray operators per field supervisor), whose duties were to monitor the performance of spray operators. Team leaders (usually an Environmental Health Technician) supervised the field supervisors, and were responsible for several teams' performance, developing schedules for when targeted communities would be sprayed, and providing general organization of the IRS campaign. The team leaders were supervised by a district coordinator, who was in charge of the overall IRS work completed by all spray teams based out of a camp site. The district coordinators for the 2013 IRS campaign were either a Principal Environmental Health Technician or a DEHO.

Other IRS campaign staff in the field, included a data manager responsible for compiling spray campaign data from the spray operators on a daily basis, and sending in weekly totals of spray data to the NMCP (via the Frontline SMS system); warners (mobilizers) who traveled by motorcycle to communities that would be sprayed to help homeowners prepare for spraying; and several drivers to transport the spray teams using MOHCC trucks.

Since the IRS campaign staff move around the province to spray various districts and wards, the NMCP has established "campsites" as the base of operations for completing IRS. Each campsite included tents for the spray campaign personnel, a storage tent for holding PPE and insecticide overnight, a soak pit (built by AIRS Zimbabwe), and wash areas for the spray teams to use after completing spraying each day.

On average spray teams stayed at each campsite for five to seven days to spray the surrounding targeted communities. Once the targeted communities were sprayed, the spray staff packed up their equipment and tents, and moved to the next camp site, where IRS campaign operations were based for spraying a new group of targeted communities. The spray teams were deployed directly from the level 3 trainings to the campsites in the initial areas that were sprayed during the first week of the IRS campaign.

Where possible, camp sites were set-up near health centers, where storage space could be used for holding PPE and insecticide, while the spray teams covered the surrounding communities. However camp sites were also found near schools, fields outside of towns, and on municipal property. The location of the camp sites was established by the provincial/district officials based on access/proximity to various amenities, most notably water, sanitary facilities and health centers. The 2013 IRS campaign used 93 campsites in the 25 pyrethroid districts.

5.2 DISTRIBUTION OF SPRAY TEAMS

Listed below in Table 7, are the distribution of spray teams per district.

The number of spray teams per district was determined by the geographical area to be sprayed as well as the number of targeted structures to be sprayed in the district, with larger districts/provinces receiving more spray teams.

However, it's key to note that spray teams were not limited to spraying only pyrethroid districts. The AIRS Zimbabwe team became aware of this issue, when monitoring the IRS campaign and noting some spray teams in the pyrethroid districts were poorly equipped. It was noted that the poorly-equipped teams were based out of the DDT districts, and had been directed to cross-over into pyrethroid districts and help with spraying. The DDT teams did not receive the same material support as the teams based in pyrethroid districts, resulting in them being poorly equipped.

TABLE 7: DISTRIBUTION OF SPRAY TEAMS PER DISTRICT

Province	District	Number of Spray Teams	Notes
Manicaland	Chimanimani	2	These two spray teams also sprayed Chipinge (DDT district).
	Makoni	2	
	Mutare	3	
	Mutasa	3	
	Hurungwe	2	
	Nyanga	2	
	Buhera	2	
Mashonaland West	Chegutu	1	
	Hurungwe	2	
	Sanyait and Mhondor Ngezi	1	
	Zvimba	1	
	Makonde	1	
Mashonaland Central	Bindura	1	The spray teams in Mashonaland Central also sprayed Mbire (DDT district)
	Guruve	1	
	Mazowe	1	
	Shavma	1	
Mashonaland East	Murewa	2	The spray teams also sprayed UMP (DDT district)
	Mutoko and Goromonzi	2	The same spray teams sprayed both Mutoko and Goromonzi districts. The spray teams also sprayed Mudzi (DDT district)
Midlands	Kwekwe	2	The spray teams also worked in DDT districts in Midlands province

Province	District	Number of Spray Teams	Notes
Masvingo	Masvingo	1	The spray teams also worked in Chiredzi and Mwenezi (DDT districts)
	Bikita	2	
	Zaka	2	
Matebeleland North	Bubi	1	The spray teams also worked in DDT districts in Matabeleland North
	Nkayi	1	
	TOTALS	37	

5.3 OVERVIEW OF AIRS ZIMBABWE'S MONITORING OF THE 2013 IRS CAMPAIGN

The ECO, ECA, and the three consultants were in the field for the majority of the IRS campaign, embedding themselves with spray teams in all 25 pyrethroid districts, and observing the implementation of the 2013 IRS campaign. The objective was to note the strengths and weaknesses of the 2013 IRS campaign, specifically with regards to environmental compliance, and to gain data and information to increase the NMCP's awareness of how to improve future IRS campaigns, or understand, where Zimbabwe's IRS programming is already performing well. These observations can be used by the NMCP, PMI, AIRS Zimbabwe, and other malaria stakeholders to develop future capacity building activities, such as trainings, and/or the introduction of best practices and innovations from IRS campaigns in other countries to help improve the quality and efficiency of IRS programming in Zimbabwe.

However, unlike the previous year, the ECO, ECA, and the consultants used a more robust set of checklists for observing the IRS campaign. These new checklists were uploaded onto smartphones, which were used by AIRS staff in all project countries during the 2013 IRS campaigns, and provided more data points for observing how IRS campaigns are implemented. All of these checklists were presented to and reviewed by the NMCP in August.

The new checklists included:

- Pre-Spray Environmental Compliance Inspection Checklists- Observations on whether store rooms, soak pits, and other infrastructure was in place and ready for the start of the IRS campaign. The data collected from this checklist helped note areas that needed PPE, or refurbishments to various infrastructure.
- Spray Operator Morning Mobilization- Observations of the activities performed by the spray teams prior to heading to the field for completing IRS, and noting whether spray operators were properly equipped.
- Homeowner Preparation- Observations of the warners (mobilizers) to prepare structures for spraying, and inform individuals living in the structures about IRS and what to do after spraying is completed.
- Spray Operator Performance- Observations of the work completed by spray operators to spray the targeted structure.
- Store Keeper Performance- Observations on the work completed by the store keepers during the spray campaign, and noting the conditions for storing insecticide, PPE, and other IRS campaign commodities.

- Transport- Observations of the vehicles used for transporting spray operators and insecticide during the IRS campaign.
- End of the Day Clean-Up- Observations of spray teams when they returned to the campsite/soak pits after spraying, and completed progressive rinsing of spray pumps, washing of PPE, and storage insecticide.
- Post Spray Inspections- Observations of infrastructure after the IRS campaign ended. This data helped AIRS Zimbabwe note various soak pits that needed further refurbishments before the next IRS campaign, and note if solid waste was collected and ready for incineration.

Overall, the AIRS Zimbabwe staff and consultants monitored all 37 spray teams in the 25 pyrethroid districts. The results of the data recorded on the checklists noted the high competency of the spray operators in the 25 spray districts. Spray operators closely followed the policies and best practices set forth in the BMP. However, in some areas where the consultants (or AIRS Zimbabwe staff) noted non-compliance with the BMP or poor spray practices, the consultants, ECO, and ECA worked with the spray operators and the environmental health technician supervising the spray operators to correct the issue.

5.3.1 USE OF SMART PHONES FOR IRS CAMPAIGN MONITORING

The use of smart phones and automating the environmental compliance checklists allowed for AIRS staff to more efficiently and quickly collect IRS campaign implementation data, limit the need for printing numerous IRS campaign monitoring checklists, and collect additional data such as GPS coordinates on where IRS campaign monitoring took place, and take pictures of soak pits, store rooms, and other interesting IRS campaign monitoring findings. Additionally, since the data collected on the smart phones instantly uploaded to a cloud-based database when Wi-Fi connections were available, this allowed staff in Zimbabwe and the home office to avoid long-hours of data entry.

AIRS Zimbabwe staff including the COP, ECO, ECA, and the consultants were all trained on how to use the smartphones via emails/training modules, and during the Short Term Technical Assistance (STTA) trip completed by the AIRS Core team's Technical Coordinator in October. All of the trained personnel were expected to use the smartphones while they were in the field monitoring the IRS campaign in all seven provinces.

FIGURE 3: AIRS ZIMBABWE'S CHIEF OF PARTY, TECHNICAL OFFICER, AND ECO USING SMARTPHONES FOR IRS CAMPAIGN MONITORING



5.4 KEY OBSERVATIONS OF THE 2013 IRS CAMPAIGN

AIRS completed an analysis of all data collected via the smart phones during the monitoring of the 2013 IRS campaign. Listed below are highlights and interesting information gained from the IRS campaign monitoring. Please view the annex for a full analysis of all data gathered.

5.4.1 STORE MANAGEMENT OBSERVATIONS DURING PRE-SPRAY EVALUATIONS

As noted in previous sections, storage facilities observed prior to the start of the IRS campaign were found to be inadequate and hazardous. Table 9 provides details regarding the findings of the AIR Zimbabwe team.

TABLE 8: OBSERVATIONS OF STORE MANAGEMENT BEFORE THE IRS CAMPAIGN

(n=169)

Question	Yes (%)	No (%)	Notes
Is there a storage facility (permanent structure) at this location?	27.8	72.2	Most PPE and insecticide were stored in campsite tents
Storage facility located an adequate distance from sensitive receptors (schools, homes, etc.)?	56.1	43.9	
Double locks on pesticide storage?	25.8	74.2	
Will facility be guarded 24 hours/day?	50.9	49.1	

Question	Yes (%)	No (%)	Notes
Obsolete or expired insecticides?	12.0	88.0	Expired pyrethroids were found in Nyanga district (Manicaland), and Shamva District (Mashonaland Central)
Pesticide stacked on pallets with intact packaging?	4.0	96.0	
Adequate PPE in inventory for Storekeeper and Visitors (Dust mask, coveralls, gloves, boots)?	56.8	43.2	
Correct pesticide Health and Safety Sheet laminated and posted?	12.5	87.5	
Emergency response procedure with phone numbers posted?	5.3	94.7	
Recording thermometer on wall?	5.3	94.7	
Fire extinguisher inside and outside storeroom?	10.5	89.5	
Fully stocked spill kit (Sand bucket, long handle brush with stiff bristle, shovel, short brush) and first aid kit (Band-Aids, gauze, antibiotic cream, eye wash, hydrocortisone cream/calamine, aspirin)?	37.5	62.5	
Containers for contaminated wastes available and clearly marked (empty sachets, masks, etc.)	26.3	73.7	

Additional Notes:

- The low numbers of PPE used by store keepers, may relate to distribution practices at the district level where spray operators and supervisors receive priority regarding PPE, and in some places store keepers were given incomplete sets of PPE.
- AIRS Zimbabwe found that most of the components of spill kits were present at the camp sites, however since spill kits were not assembled, and sand had not be gathered for filling the buckets, the AIRS Zimbabwe team and consultants were not able to check that the camp sites had fully-stocked spill kits. This led to the low percentage listed in the table above. After noting this issue AIRS Zimbabwe staff and the consultants were quick to urge IRS campaign staff to gather sand and assemble the spills kits.
- AIRS Zimbabwe has confirmed that the NMCP does require the posting of emergency procedures and pesticide health and safety sheets at camp sites. However, this requirement is rarely monitored, and most spray teams were unaware that they had to post the emergency procedures at their campsites.
- Fire extinguishers and thermometers should be priority items that the NMCP and AIRS Zimbabwe (only in Manicaland) can provide for the 2014 IRS campaign.
 - Lacking thermometers poses risks for the store room management, as IRS campaign staff are less aware if the temperature within the store room is too high and could lead

to risks of fire (as insecticides can become flammable at high temperatures), and noting if the temperature within the store room is outside of the manufacturer’s suggested storage range, which could lead to degradation of the insecticide’s active ingredient.

- Many store rooms were located right next to hospital wards, posing risks given the toxicity of the insecticides.
- However, there was more concern in the following spray areas where AIRS Zimbabwe staff noted insecticide being stored in the office of an environmental health technician:
 - Masvingo- Mukanga and Zaka Rural Health Clinic
 - Manicaland- Marangee, Nyagundi, Mutize, and Chitakatira (stored in the environmental health technician’s house)

5.4.2 PRE-SPRAY POISON CONTROL AND HEALTH OBSERVATIONS

While antidotes for the pesticides are available near the store rooms and campsites, AIRS Zimbabwe noted store keepers were not readily aware of the signs of poisoning. More concerning, 31% of spray areas visited had not completed pregnancy tests for female seasonal spray staff before the start of the IRS campaign. The lack of pregnancy testing is a significant risk for the IRS campaign. It was noted that many districts lacked pregnancy tests, or arrangements were not made with the local health center to provide pregnancy tests to female IRS campaign workers. Table 9 below provides further details regarding these issues.

TABLE 9: OBSERVATIONS OF POISON CONTROL AND PREGNANCY TESTING PRIOR TO THE START OF THE IRS CAMPAIGN

(n=169)

Question	Yes (%)	No (%)	Notes
Storekeeper trained on signs of poisoning and location of nearest treatment facility	44.6	55.4	
Antidotes to pesticides available nearby?	74.1	25.9	
Pregnancy tests administered?	68.6	31.4	Lack of pregnancy testing at Makoni and Mutare (Manicaland), Bindura and Shamva (Mashonaland Central), Murewa and Mutoko in Mashonaland East, and Bikita and Zaka in Masvingo.

5.4.3 PRE-SPRAY SOAK PIT OBSERVATIONS

Overall the soak pits were in relatively good shape prior to the start of the IRS campaign, with the exception of the placement of warning/hazard signs. The data gathered via these questions, helped AIRS Zimbabwe recognize areas where soak pits needed further refurbishments before the start of the IRS campaign.

TABLE 10: OBSERVATIONS OF SOAK PITS PRIOR TO THE START OF THE IRS CAMPAIGN

(n=169)

Question	Yes (%)	No (%)
Is the soak pit located away from water bodies, steep slopes or flood prone areas?	89.3	10.7
Are soak pit and surroundings cleared of vegetation and cleaned?	89.8	10.2
Is the soak pit correctly fenced, gated, locked & strongly built to hang pumps?	75.0	25.0
Is there an adequate water supply for personnel and clothes washing and triple rinse of pumps?	77.6	22.4
Are the washing areas properly sloped to drain to the soak pit, with no leaks or cracks?	94.3	5.7
Are there showers and toilets with adequate privacy and drainage present? (male/female)	74.8	25.2

Additional Notes:

- AIRS Zimbabwe noted that campsite toilets/wash facilities in Zaka and Bikita districts (Masvingo district) and Nyanga and Buhera districts in Manicaland needed significant refurbishments
- Given that Zimbabwe uses different types of chemical hazard signs, than the skull/cross bone design that AIRS regularly uses, AIRS Zimbabwe removed the checklist question about whether “skull and crossbones” hazard signs are placed at soak pits. It was noted that many soak pits did have the Zimbabwean chemical hazard sign (see figure 4, below), with green triangles (the color of the triangle signifies the extent of the hazard, with purple representing highly toxicity, and green representing minimal toxicity). The NMCP noted that they did not want to use a “skull and cross bones” sign on the soak pits, as they feared that people would see the skull and cross bones and perceive that IRS was dangerous to their health, and refuse IRS.

FIGURE 4: CHEMICAL HAZARD SIGNED USED AT SOAK PITS



5.4.4 OBSERVATIONS OF ACTIVITIES COMPLETED AT THE START OF THE SPRAY DAY

Generally, spray operators were well prepared for the start of the spray days. AIRS Zimbabwe did note some spray operators eating after putting on their PPE. Please view Table 11 below for more details.

TABLE 11: OBSERVATIONS OF ACTIVITIES COMPLETED AT THE START OF THE SPRAY DAY

(n=69)

Question	Yes (%)	No (%)	Notes
Have the spray operators eaten breakfast and had plenty of water to drink prior to donning PPE?	100.0	0.0	
Are SOs in full PPE before boarding truck? (Helmet/visor, overalls, boots, gloves, mask, neck protection, flashlight)	80.9	19.1	
Are any spray operators eating after donning PPE?	4.4	95.6	Noted spray operators eating in PPE in Makoni district (Manicaland) and Zaka district (Masvingo)
Do operators fill spray pumps using the contents of drums 1, 3, and 5 and 7 from the previous day's progressive rinse?	85.3	14.7	
Are barrels 1, 3, 5 and 7 empty when Spray Operators depart for the field?	85.5	14.5	
Do barrels 2, 4, and 6, have sufficient water for the day's cleanup?	84.8	15.2	

Question	Yes (%)	No (%)	Notes
Are the operators properly seated in the transport vehicle with the pump secured between their legs?	74.2	25.8	

Additional Notes:

- Due to water shortages, progressive rinse barrels in Makoni and Mutasa districts (Manicaland), Mutoko district (Mashonaland East), and Zvimba district (Mashonaland West) did not fill progressive rinse barrels, before spray teams left the campsite.
- In Mutoko and Murewa districts in Mashonaland East, Shamva district in Mashonaland Central, Bikita and Zaka districts in Masvingo, Nkayi district in Matabeleland North, and throughout Midlands province, AIRS Zimbabwe staff noted that trucks carrying the spray operators were too crowded.
- In Guruve district, several gloves, helmets, and gum boots were stolen when spray teams moved from Bakasa campsite to the Kachuta campsite.
- AIRS Zimbabwe staff noted great differences in the protection of spray teams in Matabeleland North, with spray teams based out of Bubi and Nkayi (pyrethroid districts) who were outfitted with all of the necessary PPE in good condition. Whereas their colleagues based out of DDT districts were outfitted with PPE in poor condition, or were missing critical PPE like helmets and face shields. This proved to be problematic, as teams based in DDT districts did spray pyrethroid areas.

5.4.5 HOMEOWNER PREPARATION DURING THE IRS CAMPAIGN

AIRS Zimbabwe interviewed 73 persons, about whether they received any information about the IRS campaign, prior to their structures being sprayed. AIRS Zimbabwe did find that preparation of households for IRS was excellent. The warners (mobilizers) did a great job as noted in Table 12, below.

TABLE 12: OBSERVATIONS OF HOMEOWNER PREPARATION DURING THE IRS CAMPAIGN

(n=73)

Question	Yes (%)	No (%)
Did the SO ask if the residents have been informed about the spray activities?	100.0	0.0
Have all personal belongings, food items, animals/sick persons been removed from the structure?	100.0	0.0
Have all items that cannot be removed been properly covered with plastic sheet?	41.1	58.9
Have the residents been instructed not to enter for 2 hours, and then open windows and door to air out for 30 minutes before moving back in?	100.0	0.0
Have residents been informed to wash itchy skin, and to go to a health clinic if they don't feel well after their house has been sprayed?	100.0	0.0
Are all animals kept outside the	100.0	0.0

Question	Yes (%)	No (%)
structure during spraying and for 2.5 hrs. afterward?		
If there are people (sick, elderly, babies) that cannot be moved, is this household being sprayed?	18.1	81.9
Have the residents been told to sweep up dead mosquitoes and deposit them in latrine pit and not to allow children or animal inside until this has been completed?	100.0	0.0
Are the residents told not to plaster, paint or clean the sprayed surfaces?	100.0	0.0

Additional Notes:

- Homeowners throughout Manicaland, particularly in Mutasa, Mutare, and Makoni districts were upset that spray operators did not have enough plastic sheeting to cover furniture that could not be removed from their house. AIRS Zimbabwe may need to investigate this issue further, considering the project provided 17 rolls of PVC sheeting to spray teams in Manicaland.

5.4.6 SPRAY OPERATOR PERFORMANCE DURING THE IRS CAMPAIGN

Outside of a few observations of poor use of PPE in Manicaland, Mashonaland East, and Matabeleland North, the spray operators completed quality work, spraying the right surfaces and assuring spray pumps were continually pressurized. Please view Table 13, for more information.

TABLE 13: OBSERVATIONS OF SPRAY OPERATOR PERFORMANCE DURING THE IRS CAMPAIGN

(n=108)

Question	Yes (%)	No (%)	Notes
Are SOs in full PPE? (Helmet/visor, overalls, boots, gloves, mask, neck protection, flashlight)	74.1	25.9	Spray operators in Buhera and Mutare districts (Manicaland), Goromonzi, Mutoko, and Murewa districts (Mashonaland East), and Nkayi district (Matabeleland North) were noted as not wearing full PPE during spraying.
Is mixing of the insecticide witnessed by the household resident?	100.0	0.0	
Is the tank shaken to mix the contents before pressurizing?	92.0	8.0	
Is the pump pressurized to 55 psi before spraying?	95.4	4.6	Only spray operators in Makoni and Mutare districts were noted for not pressurizing their spray tanks.
Are SOs spraying only the recommended surfaces? (walls, eaves,	93.5	6.5	Spray operators in Makoni, Mutare and Mutasa

Question	Yes (%)	No (%)	Notes
inside of doors, ceiling)			districts were noted for spraying incorrect surfaces, namely floors and metal roofs.
Are SOs spraying floors, metal roofs, the outside of doors, glass, inside of cupboards, wallpaper, food granaries, curtains, latrines, animal pens?	8.3	91.7	
Is the pump re-pressurized if the tank pressure falls below 25 psi?	91.5	8.5	Spray Operators throughout Manicaland were noted as not pressurizing pumps after spraying began.
Are any of the SOs observed smoking, drinking or eating during the day?	5.6	94.4	A few spray operators in Buhera district (Manicaland), Mutoko district (Mashonaland East), Chegutu District (Mashonaland West), and Bikita district (Masvingo) were noted for eating/drinking during spraying.
Have there been any reported accidents or complaints of pesticide exposure from residents or operators?	18.7	81.3	A small group of residents complained of Itchiness and sore eyes. However, this usually occurred when residents entered their structure before the two hour wait period had ended.

Additional Notes:

- For the few spray operators that were observed not wearing PPE, it was usually the case that they were not wearing aprons.
- Spray operators in Chegutu and Makonde districts (Mashonaland West) noted leaky spray pumps, and noted that spray pumps were in need of significant repair.
- Spray operators in Mashonaland West were also noted for not re-pressurizing their spray pumps, however some of this was due to spray pumps with faulty pressure gauges, and spray operators not knowing the pressure inside their spray tanks.
- Spray operators that originated in DDT districts but sprayed in Murewa and Mutoko districts (Mashonaland East), and in Matabeleland North, reported the effects of pesticide exposure, mainly itchiness, sore throats, and sore eyes. AIRS Zimbabwe found that most of the DDT spray teams were missing face shields (they usually wore goggles instead) and neck covers, and some spray teams did not have helmets. The lack of this PPE, as compared with their colleagues based out of pyrethroid districts, likely contributed to the spray operators complaining about the effects of insecticide exposure.

5.4.7 STORE KEEPER PERFORMANCE AND IRS INVENTORY MANAGEMENT DURING THE IRS CAMPAIGN

AIRS Zimbabwe observed both good and bad practices regarding the store keeper performance and inventory management. Good practices include the strong level of stock record keeping among the store keepers, the consistent use of PPE, and inventory control of key IRS commodities after spraying is completed. Please see Table 14, for more details.

TABLE 14: OBSERVATIONS OF STORE KEEPER PERFORMANCE AND IRS INVENTORY MANAGEMENT DURING THE IRS CAMPAIGN

(n=25)

Question	Yes (%)	No (%)	Notes
Do people entering the pesticide storage area wear masks?	100.0	0.0	
Do people wear masks, gloves, boots and overalls when handling pesticides?	100.0	0.0	
Do warehouse teams eat inside the warehouse?	16.0	84.0	Observed in Mutoko district (Mashonaland East), Makonde district (Mashonaland West), Nkayi district (Matabeleland North), and Kwekwe district (Midlands).
Is there a fully stocked emergency first aid kit present?	87.5	12.5	
Is there a thermometer for monitoring daily temperature in the storage facility?	8.0	92.0	Thermometers were only present in store rooms in Mashonaland Central where they were provided by other donor agencies for assuring the quality of other health commodities.
Is there a spill kit and a fire extinguisher in the warehouse?	60.0	40.0	Observed significant improvements in the number of spill kits found in storage areas, however fire extinguishers could not be found.
Is there any evidence of pesticide leakage (theft)?	0.0	100.0	
Is the pesticide stock stored no more than 2 m high and off of the ground?	40.0	60.0	
Is the number of sachets or bottles counted and recorded before distribution to SO?	96.0	4.0	Only Makonde district (Mashonaland West) was observed as having not counted the number of sachets provided to spray operators.
Is there a system of recording stock cards?	96.0	4.0	Makonde district was also noted for not having ready

Question	Yes (%)	No (%)	Notes
			access to stock cards for all inventory.
Are the stock cards up to date?	91.7	8.3	Chegutu district (Mashonaland West) was noted for having stock cards that were not updated.
Is there an adequate filing system?	92.0	8.0	Hurungwe district (Mashonaland West), was noted for having disorganized stock cards.
Are stocks stored on shelves and labeled?	40.0	60.0	
Are pesticides properly labeled?	80.0	20.0	In Chegutu and Hurungwe districts (Mashonaland West), Guruve district (Mashonaland Central), and Bubi (Matabeleland North) labels for insecticides had either come off the box, or were too difficult to read.
Are the insecticides distributed on a “first expiry, first out (FEFO)” system so that the insecticide that arrived first is distributed first?	92.0	8.0	Makoni district (Manicaland) and Makonde district (Mashonaland West) were noted for not practicing FEFO.
Are there any insecticides past their expiration date?	12.0	88.0	Small amounts of expired insecticide were found in Shamva district (Mashonaland Central), Bubi district (Matabeleland North), and Kwekwe district (Midlands)
Are barrels or containers for empty sachets and used masks available and clearly labeled?	80.0	20.0	These barrels were not found in Chegutu and Makonde districts (Mashonaland Central), Bubi district (Matabeleland North), and Kwekwe district (Midlands)
Does the number of empty sachets equal what the storekeeper indicates as the quantity of stock issued to date?	88.0	12.0	Poor record keeping was noted in Chegutu and Makonde districts (Mashonaland West), and Shamva district (Mashonaland Central)
Is there a strategy in place for disposing of solid waste?	92.0	8.0	

Additional Notes

- Pesticides boxes were often found on the ground and not on pallets or shelves.
- Records for pregnancy tests are not kept at spray campsites, they can be found at the nearest district health center, where the pregnancy tests were provided.

5.4.8 TRANSPORTATION DURING THE IRS CAMPAIGN

There were mixed observations of the transportation used during the IRS campaign. The MOHCC trucks were seen as excellent for not handling foodstuffs or other commodities during the IRS campaign. However, the trucks were also noted as being overcrowded, and lacking benches and other items to secure PPE and insecticide. Please see Table 15 for more details.

TABLE 15: OBSERVATIONS OF TRANSPORTATION DURING THE IRS CAMPAIGN

(n=27)

Question	Yes (%)	No (%)	Notes
Other than the pesticide sachets or bottles for the day's use, are any pesticides transported in the same vehicle with the operators?	11.1	88.9	
Are food products, animal feed, or consumer goods transported in the same truck as pesticides?	0.0	100.0	
Is there 1. a spill kit (sand, shovel, bucket), 2. spill/emergency/accident response procedures in the vehicle?	100.0	0.0	
Is there a first aid kit including eyewash in the vehicle?	88.9	11.1	
Do drivers have a telephone and appropriate PPE in case of a spill or accident?	100.0	0.0	
Can the pesticides be adequately secured and tied down in the vehicle?	53.8	46.2	
Does the spray operator transport vehicle have seats and railings?	0.0	100.0	
Is the vehicle overcrowded?	74.1	25.9	Observed commonly in Manicaland, Mashonaland Central, Mashonaland East, Masvingo, and Midlands
Is there evidence of pesticide leakage in the trucks?	0.0	100.0	

Additional Information

- AIRS usually records data on the number of drivers that completed an insecticide transport safety course, however this is not required in Zimbabwe, and few drivers had attended any courses on this subject.

- A little over 60% of drivers in all seven provinces had the necessary certification for transporting hazardous goods.
- For the expired insecticide found in Mashonaland Central, Matabeleland North, and Midlands, national IRS policies state the expired insecticide should be returned to the NMCP for chemical analysis. If the analysis notes the expired insecticide cannot be used, they will need to be disposed of at a high-temperature incinerator.

5.4.9 END OF SPRAY DAY CLEAN-UP

The spray teams did a good job of following best practices during clean-up activities at the end of the spray day. Additionally, there were a number of spray operators complaining of irritation after spraying in Mashonaland East, Mashonaland Central, Matabeleland North, and Manicaland provinces.

TABLE 16: OBSERVATIONS OF END OF SPRAY DAY CLEAN-UP

(n=104)

Question	Yes (%)	No (%)	Notes
Do the SOs continue to wear PPE on way back to the operations site?	92.2	7.8	
Upon return to storehouse, are full and empty sachets returned to stores?	100.0	0.0	
Are the empty sachets counted and stored in labeled, sealed containers?	95.2	4.8	
Do the SOs complete their daily report forms?	100.0	0.0	
Are forms checked by spray supervisors?	97.1	2.9	Only in Mutare district (Manicaland) were spray data forms not checked by IRS supervisors.
Have any SOs complained of irritation (throat, skin, etc.)?	53.8	46.2	
Is there a sloped concrete catchment area or tarpaulin spread out on the ground to catch all effluent?	87.3	12.7	
Are all people (spray operators, washers, maintenance techs) in the wash/soak pit area wearing full PPE?	91.2	8.8	
Is anyone eating or drinking prior to removing PPE and washing?	19.2	80.8	This was noted in Buhera and Mutare districts (Manicaland) Guruve district (Mashonaland Central), Hurungwe district (Mashonaland West), Zaka district (Masvingo), and Kwekwe district (Midlands).

Question	Yes (%)	No (%)	Notes
Is all pesticide remaining in pumps emptied into the #1 drum?	92.0	8.0	
Are the #2, 4 and 6 drums filled with water?	83.0	17.0	
Are spray pumps triple rinsed using the progressive rinse method?	91.9	8.1	
Are the helmets, visors, boots, and gloves rinsed off in the soak pit?	89.4	10.6	
Are the overalls washed and then hung for drying?	89.3	10.7	
Is the soak pit used to dispose of all contaminated water?	92.2	7.8	
Does all contaminated water drain properly into the soak pit?	90.3	9.7	
Is the soak pit absorbing all the effluent waste without creating a puddle and/or run off?	90.3	9.7	
Are spray pumps hung upside down to dry?	82.5	17.5	
Are washed spray pumps stored in an orderly way for easy preparation the next day?	80.2	19.8	
Are the covers placed on the 7 triple-rinse drums after all pumps are cleaned?	42.0	58.0	

Additional Notes:

- AIRS Zimbabwe staff spoke with several spray operators that complained of throat irritation and face rashes. These spray operators were usually from spray teams based out of DDT areas in Mashonaland Central, Mashonaland East, Masvingo and Matabeleland North that were not as well-equipped as their colleagues based out of pyrethroid districts. Also, spray operators in Manicaland complained of irritations, which may be related to Manicaland having the most trouble with spray operators wearing PPE correctly (many complained of incorrect sizes).
- Issues with the use of progressive rinse barrels were noted in Makoni and Mutasa districts (Manicaland), Mutoko district (Mashonaland East), and Zaka district (Masvingo). Additionally these districts, and Nkayi district (Matabeleland North), were also noted for not rinsing off PPE, and hanging spray pumps on drying lines.
- Most districts lacked covers for their progressive rinse barrels.

5.4.10 POST-IRS CAMPAIGN INSPECTION DATA

The data gathered from this checklist helped AIRS Zimbabwe, PEHOs, and DEHOs identify soak pits that need refurbishments, and store rooms that need further maintenance.

TABLE 17: POST-IRS CAMPAIGN INSPECTION DATA

(n=105)

Question	Yes (%)	No (%)	Notes
Have all the IRS items, insecticides and wastes been removed from this store?	75.2	24.8	AIRS staff noted disorganization with solid waste collection in Nyanga (Manicaland), Mazowe and Shamva (Mashonaland Central), Mutoko (Mashonaland East), Hurungwe, Zvimba and Makonde (Mashonaland West), and Bikita (Masvingo)
Has the store been washed with soap and water?	86.3	13.7	Store rooms in Manicaland and Mashonaland West needed to be cleaned.
Is the soak pit covered and the gates locked?	78.1	21.9	Data from this question led to the building of soak pit covers in Buhera, Makoni, Mutare, and Mutasa districts (Manicaland), Mazowe and Shamva (Mashonaland Central), Mutoko (Mashonaland East), Hurungwe and Makonde (Mashonaland West), Bikita (Masvingo), and Kwekwe (Midlands).
Is the soak pit and its surroundings left clean?	70.5	29.5	Several soak pits in Manicaland needed weeding

5.4.11 OTHER FINDINGS NOTED DURING THE MONITORING OF THE IRS CAMPAIGN

Listed below are several other findings that were noted by AIRS Zimbabwe while monitoring IRS programming. These ideas, however, do not necessarily apply to a checklist question.

- It was noted most IRS camp sites had inadequate stand-alone wash areas for spray operators to use for their own bathing (Figure 5, below), after returning from spraying. Instead, spray operators often used toilets and wash rooms at nearby health facilities or schools, which were often a considerable walk away. Additionally, it was unclear if the drainage areas at the toilets and wash rooms located at the schools and health centers were adequately built to degrade any insecticide wastes found in the water used for bathing.

FIGURE 5: MAKESHIFT WASH AREA AT IRS CAMPAIGN CAMPSITE



- Tents at the campsites are in very poor condition (Figure 6). Spray operators frequently noted their frustration to the AIRS Zimbabwe team about being bitten by mosquitoes and getting wet when it rains during the night, as a result of tears in the tents. Although the Global Fund had agreed to procure new tents, it's unclear if these tents were provided to the spray teams in the pyrethroid districts.

FIGURE 6: TENTS AT CAMPSITE IN MASHONALAND CENTRAL



- More concerning, since tents are used as store rooms at campsites, their poor condition and the inability to lock and secure them, led to spray operators sleeping inside to make sure the insecticide and PPE were not stolen. This is a considerable health hazard, especially with spray

operators not wearing PPE while sleeping in the storage tents (Figure 7).

FIGURE 7: STORAGE TENT IN HURUNGWE DISTRICT



- Most campsites included an area for cooking and eating food. However, the cook areas were often located in the middle of the campsites, where food risked exposure to insecticide and IRS campaign wastes.
- Female spray operators did not like using overalls, as these presented problems when they needed to use the toilet. Instead the female spray operators preferred to use “working suits” made from a similar material as the overalls with a separate top and bottom.
- A considerable number of field supervisors were not consistently putting on overalls, gum boots, and other PPE (Figure 8). The IRS supervisor found in Figure 8 (in the foreground in blue, and the three supervisors on the left in blue, yellow, and green overalls) are not wearing PPE while observing progressive rinse activities at a soak pit in Mashonaland West.

FIGURE 8: IRS SUPERVISORS NON-CONFORMITY WITH PPE



- AIRS Zimbabwe staff noted a large number of spray pumps that were used for the spray campaign were in poor condition.
 - The NMCP is aware of this issue and estimates that 500 spray pumps are in poor working condition, and should not be used during future IRS campaigns. Most pumps have been used for over seven years. Hopefully, the spray pump maintenance training completed for the 2013 IRS campaign and further maintenance of spray pumps during and after IRS campaigns, will be able to assure spray pumps are still functional and working for a long-time.
 - Additionally, Zimbabwean IRS campaign staff noted that the Micron pumps are commonly over-pressurized by spray operators, leading to disfiguration of the spray tanks and limiting their effectiveness.

FIGURE 9: DAMAGED SPRAY PUMP, USED FOR SEVERAL IRS CAMPAIGNS



- AIRS Zimbabwe staff noted that the large flatbed trucks used for transporting spray operators lacked benches and a way to assure safe transport of spray operators. AIRS has become attuned to this issue, after a spray operator in Mozambique died during the 2013 IRS campaign from falling out of a similar flatbed truck.
- Delays were encountered in Mashonaland East, Manicaland, and Masvingo provinces due to the unavailability of vehicles to transport spray teams. Many of the government vehicles used for the IRS campaign are in poor condition and in need of significant maintenance. The poor condition of vehicles meant spray schedules could not be followed as spraying had to be postponed until the trucks were repaired. This was most heavily felt in Mashonaland East where the lack of functional trucks led to the delayed start of the spray campaign by over a month, and spraying ended in the second-half of January. Additionally, some provinces also lacked vehicles for supervision due to inadequate funding to procure fuel.

5.4.12 REVIEW OF NMCP'S IRS CAMPAIGN SUPERVISION DATA

As noted in section 4.1, "Environmental Compliance Training" the Zimbabwean government agreed that it would be best to use a checklist to note its own observations of the 2013 IRS campaign, and decided to use a checklist similar to the one developed by AIRS Zimbabwe for the 2012 IRS campaign. The checklist used by the Zimbabwean government included a variety of environmental compliance indicators, ranging from PPE use, to correct practices for spraying walls, to transportation/storage practices. NMCP worked with staff at the provincial and district health offices to finalize their environmental compliance checklist which was reviewed again, and adopted into IRS campaign monitoring protocol during the level 1 training. Please see the annex to view an example of a completed checklist. During the level 3 trainings, presentations were made to familiarize IRS campaign staff with the checklists and the purpose of the data collected on the checklists. The NMCP instructed the IRS campaign staff to complete the checklists daily.

During March, 2014, AIRS helped the NMCP enter the data collected on the checklists into a database for analysis. AIRS Zimbabwe has only received data from Manicaland, Mashonaland West, Mashonaland Central, Masvingo, and Matabeleland North provinces, and is still waiting for the checklist data from Mashonaland East and Midlands. AIRS is available to help enter this data at a later time.

Overall, data from 3,031 checklists forms were entered into the database. The quick analysis by AIRS Zimbabwe confirmed that implementation of the 2013 IRS campaign was very good. Further analysis of this data will be completed as needed by the NMCP. Key findings from the analysis of the NMCP's checklist data noted:

- Face shield usage was less common in Manicaland and Matabeleland North, however this was likely related to IRS campaign staff observing the work of teams based out of DDT districts, who were not provided face shields;
- Spray teams in Manicaland were less likely to assure domestic animals were outside during spraying (90% of spray operators in Manicaland, as compared to 97 to 100% for all other provinces);
- Spraying behind immovable furniture was also noted as a problem area, with only 70% of spray operators in Manicaland, 69.4% in Masvingo, and 89% in Matabeleland North complying;
- Progressive Rinsing of spray pumps was also noted as lower for spray operators in Manicaland (91%) and Masvingo (90%);
- The use of wash areas for washing PPE was noted as very low in Matabeleland North, where only 79% of spray operators complied.

5.5 POST-SPRAY CAMPAIGN INSPECTION

The AIRS Zimbabwe ECO, ECA and the three local consultants carried out post-spray inspections during January and February 2014. Where possible, the NMCP, PEHOs and DEHOs participated in the inspections. Similar to the monitoring of the IRS campaign, a brief checklist found on the smartphones was used during the post-spray environmental inspection to collect data to ensure the spray campaign was closed-out properly. The ECO, ECA, and the consultants noted the condition of the store rooms at the provincial-level and at the 24 district store rooms that were holding insecticide or IRS equipment, whether the store rooms had organized the IRS campaign's solid waste, and had been washed and cleaned after the IRS campaign.

The post-spray inspection also looked into the condition of the soak pits and assured that all soak pits received a cover that was locked in place. AIRS Zimbabwe did build 10 lockable soak pit covers for the soak pits that did not have covers initially built. The remaining soak pits from 2012 and 2013 IRS campaign already had soak pit covers in-place. AIRS Zimbabwe did note that some soak pits, especially in Murewa, Mutoko, Chegutu, and Hurungwe districts, needed some refurbishments before the start of the 2014 IRS campaign. Examples of soak pit damage include cracks in the wash basin area and insect infestation on fence poles.

The post-spray inspection also took inventory of the items (not counting various consumables such as soap or office supplies) that AIRS Zimbabwe provided to the districts for the IRS campaign. We note the remaining PPE inventory at the end of the 2013 spray campaign in Table 18.

TABLE 18: QUANTITIES OF PPE PROVIDED BY AIRS ZIMBABWE LEFT-OVER AT THE END OF THE 2013 IRS CAMPAIGN

Item	Manicaland		Mashonaland Central		Mashonaland East		Mashonaland West		Masvingo		Matabeleland North		Midlands	
	Before IRS Campaign	After IRS Campaign												
Overalls	874	266	258	0	313	109	385	56	318	65	127	0	125	0
Gum Boots	444	9	127	0	157	31	185	0	158	20	63	0	63	0
Helmets	442	431	132	125	157	152	190	190	158	156	63	63	64	64
Face Shields	442	22	128	60	158	97	188	136	158	86	63	47	63	63
Aprons	450	21	126	0	158	86	183	133	157	3	63	15	157	63
Gloves	884	162	248	0	316	63	380	32	316	90	126	0	316	63
Satchels	450	18	125	0	157	31	185	0	157	7	63	50	157	0
First Aid Kits	14	16	9	9	7	5	5	6	7	7	4	3	7	4
Progressive Rinse Barrels	6	6	32	32	10	10	4	4	38	38	30	30	29	29

The NMCP had made it a policy for the 2013 IRS campaign to collect as much of the PPE and IRS materials as possible after the IRS campaign, in order to re-use the inventory in future IRS campaigns, and thereby avoid procuring a large amount of PPE and IRS materials during the 2014 IRS campaign. However, AIRS Zimbabwe (as noted in the table 18) has noted that most of the PPE items were not returned or were noted as too damaged for use during future IRS campaigns.

AIRS did a quick cost-estimate of the overalls, gumboots, helmets, face shields, aprons, gloves, and satchels that were noted as too damaged or not returned at the end of the IRS campaign (quantities “Before IRS Campaign”-“After IRS Campaign” x Unit Cost for the IRS materials), and estimates that \$66,103 of these materials were “lost” or are unavailable for use during the 2014 IRS campaign, and will likely need to be replaced before the next IRS campaign. This is a significant cost for future IRS programming, and can be decreased if policies to return all IRS materials are enforced, and IRS campaigns staff make sure IRS materials receive better care during the IRS campaign. Further notes regarding the use of PPE during the 2013 IRS campaign include:

- IRS campaign staff noted the gum boots, aprons, and overalls were ripped at the end of the IRS campaign and could not be re-used. AIRS was surprised to learn the boots, aprons, and overalls could not be used after one IRS campaign. AIRS does note that the IRS campaign in Zimbabwe lasts longer than most IRS programs and there is more wear and tear on PPE. However, in all IRS programs managed by AIRS, gum boots, aprons, and overalls are readily used for three spray campaigns.
 - AIRS Zimbabwe has noted that most of the unusable PPE was placed in piles within the provincial and district warehouses. AIRS Zimbabwe is trying to determine how the unusable PPE will be disposed, and will provide assistance to the NMCP as needed.
- IRS campaign staff also noted that the satchels and face shields were damaged pretty easily, and were often broken by the end of the IRS campaign. Since this is the second year that the satchels and face shield were noted for poor quality, AIRS Zimbabwe will look into finding other vendors for the 2014 IRS campaign.
- It was noted that the final inventory for first-aid kits in Manicaland and Masvingo was higher than the quantity of kits provided to the provinces. After further discussions, it was noted that these provinces either procured or received extra first-aid kits from other organizations. The other provinces noted that they used the supplies in the first aid kits during the IRS campaign, and this led to them having fewer first-aid kits than at the beginning of the campaign.

6. DATA RESULTS OF 2013 IRS CAMPAIGN

6.1 M&E SYSTEM FOR THE 2013 IRS CAMPAIGN, AND USE OF THE FRONTLINE SMS SYSTEM

IRS campaign data (number of rooms sprayed and number of people protected) was collected on a daily basis by each spray operator. The data was entered into a “notebook”, and at the end of spray day, spray operators submitted their notebooks to IRS Campaign data manager based at each campsite. The data manager reviewed all data, corrected mathematical errors, and entered the data into a daily summary sheet. The daily summary sheet was usually shared with all spray staff at each campsite every evening; to help the spray staff understand their progress. At the end of each week, the data manager compiled all daily summary sheets for the last seven days, and inputted the totals for the week into an IRS summary sheet.

The totals on the weekly IRS summary sheet were then entered into the Frontline SMS system that was uploaded on to each of the mobile phones that AIRS Zimbabwe provided for use during the 2013 IRS campaign. The Frontline SMS system was specifically designed for use for national IRS campaign in Zimbabwe, and consists of a series of forms that are sent via SMS directly to the NMCP, and then entered into the District Health Information System 2 (DHIS2).

The IRS campaign data was then accessible to authorized IRS campaign personnel (mainly NMCP staff). However, other IRS campaign staff, such as DEHOs and PEHOs, usually received the data, after the NMCP printed out hardcopies of the spray campaign data, and sent them to their offices. This usually took place one to two weeks after the IRS campaign data was sent-in via the Frontline SMS system. Its key to note at this point, some of the IRS campaign data may have been up to three weeks old. After speaking with provincial, district, and NMCP staff, it was noted that the lengthy time for releasing the data to IRS staff at the district and province levels was related to:

- Only one M&E staff member was employed at the NMCP and was required to transfer all of the Frontline SMS data from all spray areas to the DHIS2, and thereafter develop spray reports in hardcopy to send-out to the provinces and districts. This ended up being a considerable workload for one person.
- IRS campaign data sent in via the Frontline SMS system was sent to collector software, however only a few people on the NMCP had access to the collector software. Since most of the NMCP staff were busy with other IRS campaign activities, they had limited time to help the M&E staff member to organize, transfer and release the data to districts and provinces.
- Since the data reported to the Frontline SMS system was only provided on a weekly basis, if a Data Assistant in the field was late with their submission of data this led to further delays in organizing, transferring, and reporting the data to provinces and districts.

The NMCP, provinces and districts health offices welcomed the use of the Frontline SMS system as it did help to compile all IRS campaign data from all spray areas. This was an improvement on the 2012 IRS campaign, when spray campaign data was incomplete for many spray areas and not submitted regularly.

However, some concerns about the Frontline SMS system were raised by various IRS campaign staff during the post-spray evaluation meetings. These included:

- The limited access to the IRS campaign data meant district and provincial health staff were not informed about IRS campaign progress and coverage, until quite sometime after various areas were sprayed.
 - Given the delay in receiving the data, district and provincial staff were unsure how to make adjustments to the spray program schedule or use the data to help monitor the IRS campaign.
- After the data was entered into the Frontline SMS system, it could not be edited or changed, in case of a mistake or the need to make an adjustment. If it was necessary to correct the data, the data manager was asked to re-enter the revised data and send it back in via the Frontline SMS system. At this point there were two sets of data for a given week, and the NMCP staff had to keep track of which data-set was the corrected data, and which data-set was incorrect. This led to some confusion, and delays in deciding on the final data for the 2013 IRS campaign.
- Some provinces were not comfortable allowing the data manager to send IRS campaign data straight to the NMCP and the DHIS 2 database, before they had a chance to review the data. As this limited the opportunity to give feedback to spray teams, and make adjustments in case of a data entry error.

The NMCP is moving forward with several ideas to improve the Frontline SMS system, particularly regarding the delay in sending data to the IRS staff at the province and district-levels, this includes:

- Hiring another M&E staff member and a database person to help with the organization of the data, transferring the Frontline SMS data to the DHIS2, and developing reports for the IRS staff in the field.
- Considering expanding access to the Frontline SMS data collector to district and provincial health staff, to allow them to look at the Frontline SMS data directly.

6.2 CONVERTING “ROOMS” TO STRUCTURES

AIRS Zimbabwe received the NMCP’s 2013 IRS campaign data in February, 2014. Since the IRS program in Zimbabwe collects data on the number of *rooms* (found and) sprayed while PMI requires countries to report the number of *structures* (found and) sprayed, during IRS campaigns, during the 2012 IRS campaign AIRS Zimbabwe collected data to determine an algorithm for converting the average number of rooms per structure. Overall, AIRS Zimbabwe determined on average there are 1.69 rooms per structure. Please see the 2012 End of Spray Report for more details.

Using this algorithm, AIRS Zimbabwe converted the number of rooms sprayed during the 2013 IRS campaign, as reported by the NMCP, into the PMI-standard of number of structures sprayed during the 2013 IRS campaign.

6.3 RESULTS OF 2013 IRS CAMPAIGN

Overall, it was noted that 622,299 structures were sprayed out of 685,946 structures found and 1,431,643 people were protected across the 25 pyrethroid districts in seven provinces. The overall spray coverage rate was 90.72% percent of structures visited by the spray operators were sprayed. A breakdown of the PMI supported 2013 IRS campaign results by province and district are noted in Table 19.

TABLE 19: SUMMARY OF SPRAY COVERAGE DURING THE 2013 IRS CAMPAIGN

Province	Districts	Target Rooms	Rooms sprayed	Target Structures	Sprayed Structures	Spray Coverage, %	Target Population	Population protected	Pop Protected, %
Manicaland	Chimanimani	48,768	33,768	25,400	17,588	69.2%	41,482	41,482	100.0%
	Makoni	51,000	48,294	26,563	25,153	94.7%	55,978	53,747	96.0%
	Mutare	93,344	74,308	48,617	38,702	79.6%	103,136	97,838	94.9%
	Mutasa	82,758	71,877	43,103	37,436	86.9%	99,200	84,580	85.3%
	Nyanga	81,153	72,613	42,267	37,819	89.5%	96,658	85,607	88.6%
	Buhera	65,156	61,107	33,935	31,827	93.8%	115,667	90,296	78.1%
	Subtotal	422,179	361,967	219,885	188,524	85.7%	512,121	453,550	88.6%
Mashonaland Central	Bindura	33,185	31,446	19,636	18,607	94.8%	49,357	45,717	92.6%
	Guruve	33,244	30,455	19,671	18,021	91.6%	59,486	54,336	91.3%
	Mazowe	33,118	31,473	19,596	18,623	95.03%	38,374	37,906	98.8%
	Shamva	41,325	39,325	24,453	23,269	95.2%	60,902	58,354	95.8%
	Subtotal	140,872	132,699	83,356	78,520	94.16%	208,119	196,313	94.3%
Mashonaland East	Murewa	72,223	70,086	43,508	42,220	97.0%	80,311	78,525	97.8%
	Mutoko	94,081	89,906	56,675	54,160	95.6%	129,682	118,736	91.6%
	Goromonzi	26,373	25,196	15,887	15,178	95.5%	30,454	28,113	92.3%
	Subtotal	192,677	185,188	116,070	111,559	96.1%	240,447	225,373	93.7%
Mashonaland West	Chegutu	22,853	22,586	14,649	14,478	98.8%	29,836	29,693	99.5%
	Hurungwe	60,791	58,470	38,969	37,481	96.2%	80,725	82,969	102.8%
	Sanyati	15,292	14,923	9,803	9,566	97.6%	20,163	20,100	99.7%
	Mhondoro Ngezi	5,337	5,267	3,421	3,376	98.7%	8,039	8,020	99.8%
	Zvimba	24,875	23,865	15,946	15,298	95.9%	31,727	30,655	96.6%
	Makonde	45,642	44,758	29,258	28,691	98.1%	62,486	60,121	96.2%
	Subtotal	174,790	169,869	113,045	108,890	97.2%	232,976	231,558	99.4%

Province	Districts	Target Rooms	Rooms sprayed	Target Structures	Sprayed Structures	Spray Coverage, %	Target Population	Population protected	Pop Protected, %
Masvingo	Bikita	42,484	39,869	25,138	23,591	93.8%	64,838	58,897	90.8%
	Zaka	44,250	40,552	26,183	23,995	91.6%	53,403	60,962	114.2%
	Masvingo	23,568	16,771	13,946	9,924	71.2%	28,868	25,629	88.8%
	Subtotal	110,302	97,192	65,267	57,510	88.1%	147,109	145,488	98.9%
Matebeleland North	Nkayi	35,198	23,806	20,827	14,086	67.6%	52,321	40,233	76.9%
	Bubi	29,678	25,741	17,561	15,231	86.7%	39,174	40,469	103.3%
	Subtotal	64,876	49,547	38,388	29,318	76.4%	91,495	80,702	88.2%
Midlands	Kwekwe	84,390	81,083	49,935	47,978	96.08%	98,925	98,659	99.7%
	Subtotal	84,390	81,083	49,935	47,978	96.08%	98,925	98,659	99.7%
Total		1,190,086	1,077,545	685,946	622,299	90.72%	1,531,192	1,431,643	93.5%

Notes on Spray Coverage for the 2013 IRS campaign:

- In Chimanimani district vehicle issues led to low spray coverage. Vehicles used for transporting spray operators were in need of repair for several days, causing spray operators to skip spraying several communities. When the vehicles were repaired, district and provincial officials chose to continue with the IRS campaign schedule and versus re-visiting the communities that had been skipped. This was combined with the warners' motorcycles in the district not running for several days at various points of the IRS campaign, and the warners were unable to visit targeted communities and prepare people for the IRS campaign. Without the warners work, spray operators visited communities and found structures that were locked, with their owners away. Unfortunately, mop-up campaigns were not organized for spray operators to revisit these communities and spray when the structure owners were present.

6.4 POSSIBLE REASONS STRUCTURES WERE NOT SPRAYED

Although the IRS campaign sprayed 91.4% of the structures found, the data received from the NMCP reported that 58,374 structures were not sprayed in 2013. According to the NMCP, and per discussions with MOHCC, listed below are the possible reasons why a structure was not sprayed:

- No one home or present at the time of spray;
- Household owners noted that they use an ITN and therefore refused IRS;
- Infant/baby sleeping in the sprayable structure/room;
- Water shortage -- Residents refused IRS when spray operators asked for water from their well or tap to mix the insecticide. Apparently, due to a drought in some areas, residents did not want to provide their own water to the spray operators;
- Free maize seed distribution coincided with spraying in certain villages and residents were not home;
- A small number of people noted an allergy to IRS insecticides and would not allow their houses to be sprayed;
- Due to religious beliefs, some households do not allow chemicals (such as IRS insecticide) in their houses;

7. ENTOMOLOGY

Entomological surveillance for the 2013 IRS campaign began in September 2013 and is likely to continue through April, 2014. Listed below is a summary of the entomological surveillance work completed for the 2013 IRS campaign. A final entomological report will be submitted to PMI Zimbabwe in May 2014 and will provide more details about the entomological surveillance findings from the 2013 IRS campaign.

It should be noted that AIRS Zimbabwe is currently waiting for the National Institutes of Health Research (NIHR) to perform molecular analysis and identification of vector mosquitoes at the sibling species level. However, since the NIHR person assigned to complete the molecular analysis is leaving the NIHR, AIRS Zimbabwe expects delays for the completion of the molecular analysis.

7.1 SENTINEL SITES USED FOR ENTOMOLOGICAL SURVEILLANCE

For the entomological surveillance activities completed by AIRS Zimbabwe, the following sentinel sites were used.

- **Kawere (Mashonaland East, Mutoko District)**: Baseline entomological surveillance data was collected at Kawere in September, 2013. Kawere was sprayed with Deltamethrin in December, 2013; with cone bioassay tests starting 24 hours after the area was sprayed, and continuing on a monthly basis through March, 2014. Routine entomological surveillance monitoring was also completed in October, November, December, January, February, and March at Kawere. The routine entomological surveillance monitoring included measuring indoor mosquito resting densities and CDC light trap collections.
- **Kasimure (Mashonaland West, Hurungwe District)**: Baseline entomological surveillance data was collected at Kasimure in September, 2013. Kasimure was sprayed with Lambdacyhalothrin in December, 2013; with cone bioassay tests starting 24 hours after the area was sprayed, and continuing on a monthly basis through March, 2014. Routine entomological surveillance monitoring was completed in October, 2013. Cone bioassay tests are on-going as mortality rates for mosquitoes remain above 70%.
- **Burma Valley (Manicaland, Mutare District)**: Baseline entomological surveillance was performed at Burma Valley starting in September, 2013. The area around Burma Valley was sprayed with Lambdacyhalothrin in October, 2013, with cone bioassays tests starting 24 hours after the area was sprayed, and continuing on a monthly basis through March, 2014. Routine entomological surveillance monitoring was completed October, 2013 through March, 2014.
- **Chabwino Farm (Control) (Goromonzi District, Mashonaland East)**: Chabwino Farm was identified as a control site following consultative meetings between AIRS Zimbabwe, the Goromonzi District Health Executive, the Mashonaland East PEHO, and NMCP in January, 2013. The community at Chabwino farm does not receive vector control interventions, including IRS and ITNs. Routine vector monitoring began in September, 2013, and has continued monthly through March, 2014.

7.2 RESIDUAL EFFICACY

Cone bioassay tests to determine the residual efficacy of the insecticide sprayed were completed 24-hours after the area around the sentinel site was sprayed. Bioassays were completed in ten houses per sentinel site. Control cones were set-up also at the sentinel site on clean paper.

Field collected *Anopheles gambiae* s.l. from Masakadza, Gokwe South District (Midlands Province) were used in almost all bioassay tests, since the insectary at the NIHR was undergoing refurbishments and could not provide a laboratory-reared susceptible strain (see section 7.6, “Development of a Susceptible Colony” for more information). The susceptibility of *An. gambiae* s.l. from Gokwe South to pyrethroid-class insecticide (Lambdacyhalothrin) was established via susceptibility testing by AIRS Zimbabwe in August, 2013 (Other pyrethroid class insecticides, such as Deltamethrin, were not selected for baseline data collection since the NMCP had not indicated their use for the 2013 IRS campaign during level-1 training). Please see table 20, below for the results of the susceptibility testing.

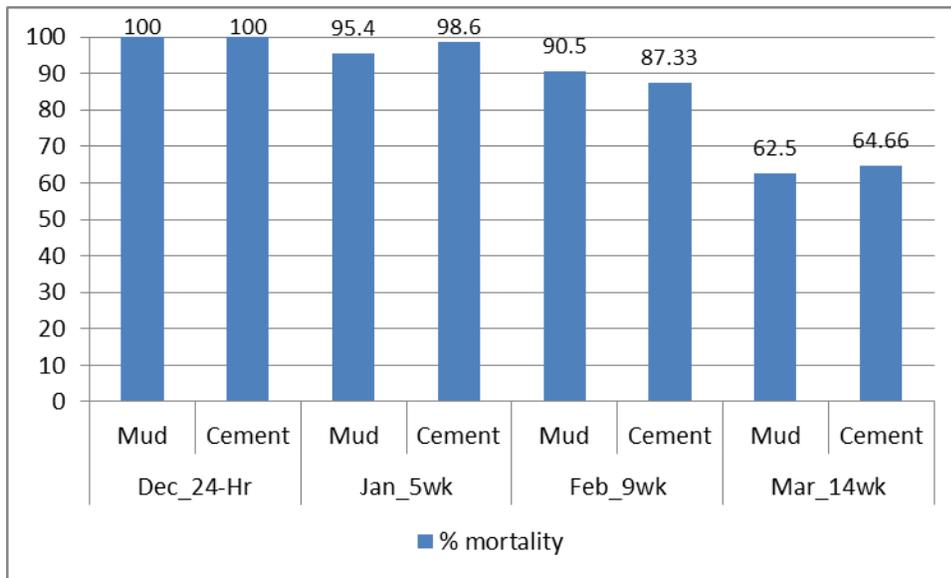
TABLE 20: RESULTS OF SUSCEPTIBILITY TESTING FOR AN. GAMBIAE S.L. FROM GOKWE SOUTH

Insecticide	Total Test Replicates	Knockdown after 30 Minutes (%)	Knockdown after 60 Minutes (5%)	Percent Mortality after 24 hours
Lambdacyhalothrin (0.05%)	103 (5)	53 (51.45%)	103 (100%)	103 (100%)
Silicone Oil (Pyrethroid Control)	20 (1)	0 (0%)	0 (0%)	0 (0%)

7.2.1 MASHONALAND EAST

Cone bioassay tests to ascertain quality of spray was done on December 2, 2013, 24 hours after Kawere was sprayed. The 100% mortality recorded 24-hours after the spraying was completed, indicated good spray quality, on the two common wall surfaces (i.e., mud and cement) in the province. Subsequent cone bioassay tests that were done in the same houses monthly showed progressive decay of insecticide to below 70% in March, 14 weeks post-spray. Figure 10 presents the results of the bioassay tests in Kawere.

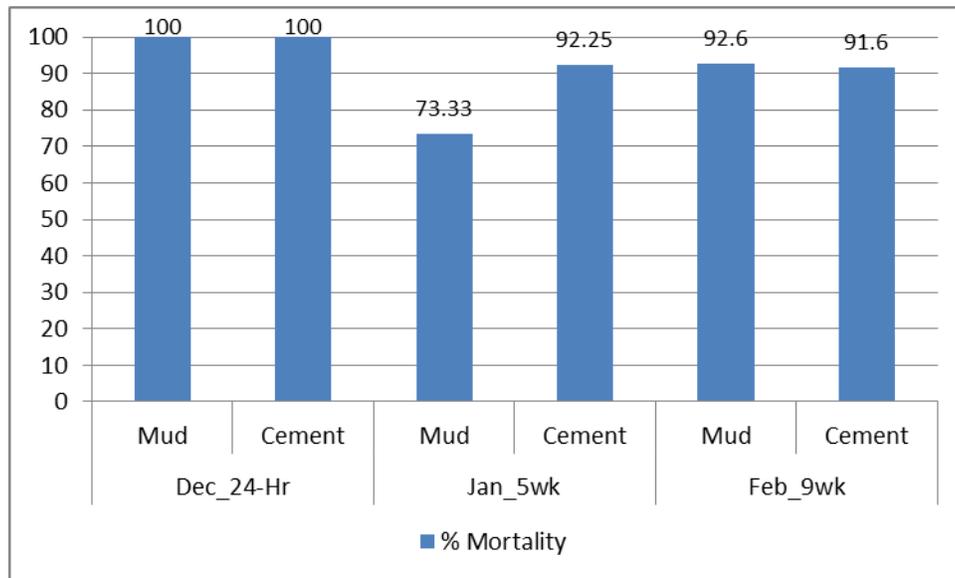
FIGURE 10: MORTALITY RATES OF FIELD-COLLECTED ANOPHELES GAMBIAE S.L. AFTER EXPOSURE TO INSECTICIDE SPRAYED SURFACES AT KAWERE SENTINEL SITE



7.2.2 MASHONALAND WEST

Cone bioassay tests to ascertain quality of spray was completed on December 16, 2013 at Kasimure sentinel site. The 100% mortality recorded 24 hours after spraying was completed in the area, indicated good spray quality on the two most common wall surfaces (i.e., mud and cement) in the province. Subsequent cone bioassay tests that were done in the same houses monthly showed insecticide decay to 92.1%, eight weeks post-spray. It is important to note the mortality rates for mud walls increased in February. This is likely the result of using wild mosquitoes, due to their variability, as mosquitoes caught during different months may be more or less resistant to the amount of insecticide on the walls. Since residual efficacy remains high in Mashonaland West, bioassays are continuing through April and possibly May. Figure 11 presents the results of the bioassay tests in Kasimure.

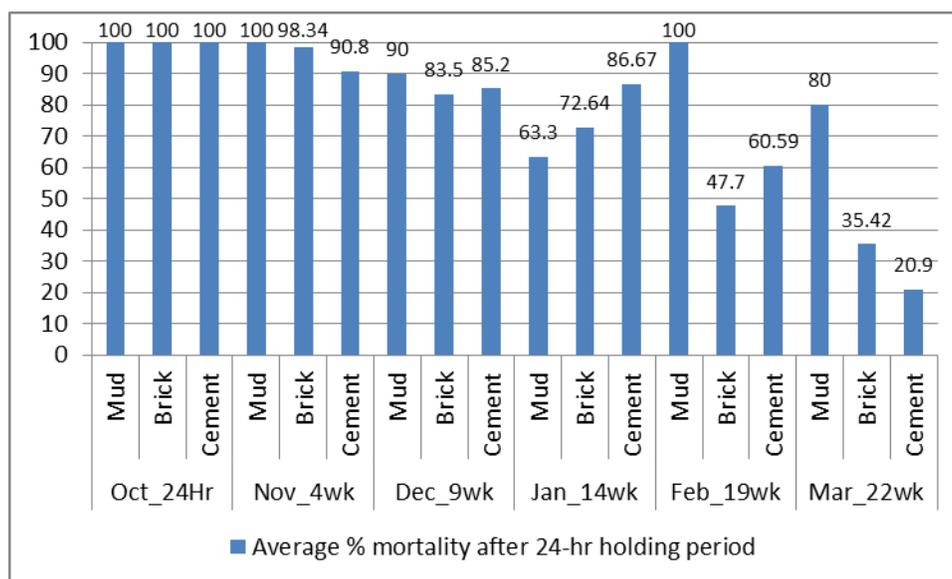
FIGURE 11: MORTALITY RATES OF FIELD-COLLECTED ANOPHELES GAMBIAE S.L. AFTER EXPOSURE TO INSECTICIDE SPRAYED SURFACES AT KASIMURE SENTINEL SITE



7.2.3 MANICALAND

Cone bioassay tests to ascertain quality of spraying were completed on October 3, 2013 at Burma Valley sentinel site. The 100% mortality recorded 24-hours after spraying was completed in the area, indicated good spray quality, on three types of common wall surfaces in the province (i.e., brick, cement, and mud plaster). A susceptible *An. arabiensis* strain KGB strain from the NIHR insectary was used in one house during the T0 cone bioassay tests (only a limited quantity was available, and this was the only time that susceptible mosquitoes could be used for bioassays), while field-collected *An. gambiae* s.l. was used in all other houses during T0, and during subsequent bioassay tests. Follow-up cone bioassay tests were completed until March, 2014 when mortality rates had decreased below 80%, 22 weeks after the initial spraying. It is important to note that mortality rates actually increased for mud (in February) and cement (in January). Again, this is likely the result of using wild mosquitoes and their varied resistance to the insecticide sprayed. Please see figure 12, for more information.

FIGURE 12: MORTALITY RATES OF FIELD-COLLECTED ANOPHELES GAMBIAE S.L. AFTER EXPOSURE TO INSECTICIDE SPRAYED SURFACES AT BURMA VALLEY SENTINEL SITE



7.3 INSECTICIDE SUSCEPTIBILITY

Susceptibility testing is currently on-going in April, 2014. Please find listed in this section, the susceptibility data that has been received and analyzed as of mid-April, 2014. The remaining susceptibility data will be analyzed and described in an upcoming susceptibility testing report that will be developed in late-April.

Insecticide susceptibility tests were done primarily with *Anopheles gambiae s.l.* However, for Manicaland, AIRS Zimbabwe tried to use *Anopheles funestus* given it is the most prevalent vector species in the province. Due to the volume of mosquitoes needed for susceptibility testing, vector species were collected from nine sentinel sites throughout Zimbabwe.

7.3.1 MANICALAND

For Manicaland, *An. funestus* showed resistance to pyrethroid-class insecticides, Lambda-cyhalothrin and Etofenprox. *An. funestus* is fully susceptible to organophosphates and DDT. Table 21, denotes results from susceptibility testing completed in Manicaland, as of March 2014.

TABLE 21: MORTALITY RATES OF ANOPHELES FUNESTUS FIELD POPULATIONS AT BURMA VALLEY (MANICALAND PROVINCE)

Insecticide	Burma Valley (Manicaland)			
	Total tested (replicates)	KD after 30 min (%)	KD after 60 min (%)	% mortality 24-hour
Lambda-cyhalothrin (0.05%)	46 (2)	1 (2.17%)	0 (0%)	3 (6.52%)
Etofenprox (0.5%)	33 (2)	0 (0%)	0 (0%)	1 (3.03%)
DDT (4%)	36 (2)	5 (13.88%)	36 (100%)	36 (100%)

Insecticide	Burma Valley (Manicaland)			
	Total tested (replicates)	KD after 30 min (%)	KD after 60 min (%)	% mortality 24-hour
Pirimiphos-methyl (1.0%)	30 (2)	23 (76.66%)	30 (100%)	30 (100%)
<i>Silicone Oil (Pyrethroid control)</i>	20 (1)	0 (0%)	0 (0%)	1 (5%)
<i>Silicone Oil (Pyrethroid control)</i>	20 (1)	0 (0%)	0 (0%)	0 (0%)
<i>Olive Oil (OP/carbamate control)</i>	17 (1)	0 (0%)	0 (0%)	0 (0%)

7.3.2 MASHONALAND CENTRAL

For Mashonaland Central, *An. gambiae* s.l. was fully susceptible to pyrethroids, carbamates, organophosphates, and DDT. Table 22, denotes results from susceptibility testing completed in Mashonaland Central.

TABLE 22: MORTALITY RATES OF ANOPHELES GAMBIAE FIELD POPULATIONS AT OLD MAZOWE BRIDGE (MASHONALAND CENTRAL PROVINCE)

Insecticide	Old Mazowe Bridge (Mashonaland Central)			
	Total tested (replicates)	KD after 30 min (%)	KD after 60 min (%)	% mortality 24-hour
Lambdacyhalothrin (0.05%)	93 (4)	71 (76.34%)	93 (100%)	93 (100%)
Deltamethrin (0.05%)	69 (3)	57 (82.60%)	64 (92.75%)	69 (100%)
Etofenprox (0.5%)	50 (2)	30 (60%)	49 (98%)	50 (100%)
DDT (4%)	98 (4)	15 (15.30%)	86 (87.75%)	98 (100%)
Pirimiphos-methyl (1.0%)	52 (2)	5 (9.61%)	36 (69.23%)	52 (100%)
Bendiocarb (0.1%)	53 (2)	23 (43.39%)	51 (96.22%)	53 (100%)
<i>Silicone Oil (Pyrethroid control)</i>	50 (2)	0 (0%)	0 (0%)	0 (0%)
<i>Risella Oil (OC control)</i>	15 (1)	0 (0%)	0 (0%)	0 (0%)
<i>Olive Oil (OP/C control)</i>	23 (1)	0 (0%)	0 (0%)	0 (0%)

7.3.3 MASHONALAND EAST

For Mashonaland East, the *An. gambiae* s.l. was fully susceptible to pyrethroids, DDT, and organophosphates. Tests on Bendiocarb could not be completed in April due to insufficient numbers of mosquitoes at the breeding sites. Table 23, denotes results from susceptibility testing completed in Mashonaland East, as of April, 2014.

TABLE 23: MORTALITY RATES OF ANOPHELES GAMBIAE FIELD POPULATIONS AT KAWERE (MASHONALAND EAST PROVINCE)

Insecticide	Kawere (Mashonaland East)			
	Total tested (replicates)	KD after 30 min (%)	KD after 60 min (%)	% mortality 24-hour
Lambdacyhalothrin (0.05%)	47 (2)	24 (51%)	44 (93.61%)	47 (100%)
Deltamethrin (0.05%)	25 (1)	17 (68%)	25 (100%)	25 (100%)
DDT (4%)	25 (1)	5 (20%)	22 (88%)	25 (100%)
Pirimiphos-methyl (1.0%)	46 (2)	9 (19.56%)	42 (91.30%)	46 (100%)
<i>Silicone Oil (Pyrethroid control)</i>	20 (1)	0 (0%)	0 (0%)	1 (5%)
<i>Olive Oil (OP/carbamate control)</i>	22 (1)	0 (0%)	0 (0%)	1 (4.54%)
<i>Risella Oil (OC control)</i>	20 (1)	0 (0%)	0 (0%)	0 (0%)

7.3.4 MASHONALAND WEST

For Mashonaland West, the *An. gambiae* s.l. was fully susceptible to DDT and organophosphate. Possible resistance was noted for pyrethroids (Etofenprox). Full resistance was noted for carbamates and pyrethroids(Lambdacyhalothrin) Table 24, denotes results from susceptibility testing completed in Mashonaland West, as of April, 2014.

TABLE 24: MORTALITY RATES OF ANOPHELES GAMBIAE FIELD POPULATIONS AT KASIMURE (MASHONALAND WEST PROVINCE)

Insecticide	Kasimure (Mashonaland West)			
	Total tested (replicates)	KD after 30 min (%)	KD after 60 min (%)	% mortality 24-hour
Lambdacyhalothrin (0.05%)	113 (5)	66 (58.40%)	109 (96.46%)	98 (86.72%)
DDT (4%)	95 (4)	49 (51.57%)	94 (98.94%)	95 (100%)
Pirimiphos-methyl (1.0%)	99 (4)	1 (1.01%)	22 (22.22%)	99 (100%)
Bendiocarb (0.1%)	50 (2)	0 (0%)	41 (82%)	44 (88%)
Etofenprox (0.5%)	50 (2)	45 (90%)	50 (100%)	48 (96%)
Silicone oil (pyrethroid control)	70 (3)	0 (0%)	0 (0%)	0 (0%)
Olive oil (OP/Carbamate control)	50 (2)	0 (0%)	0 (0%)	0 (0%)
Risella oil (OC control)	70 (3)	0 (0%)	0 (0%)	0 (0%)

7.3.5 MATABELELAND NORTH

For Matabeleland North the *An. gambiae* s.l. was fully susceptible to carbamates, DDT, and organophosphates. Resistance was noted for pyrethroids (Lambdacyhalothrin). Table 25, denotes results from susceptibility testing completed in Matabeleland North.

TABLE 25: MORTALITY RATES OF ANOPHELES GAMBIAE FIELD POPULATIONS AT MANJOLO (MATABELELAND NORTH PROVINCE)

Insecticide	Manjolo (Matabeleland North)			
	Total tested (replicates)	KD after 30 min (%)	KD after 60 min (%)	% mortality 24-hour
Lambdacyhalothrin (0.05%)	88 (4)	51 (57.95%)	84 (95.45%)	71 (80.68%)
Bendiocarb (0.1%)	89 (4)	67 (75.28%)	89 (100%)	89 (100%)
DDT (4%)	88 (4)	43 (48.86%)	88 (100%)	88 (100%)
Pirimiphos-methyl (1.0%)	93 (4)	7 (7.52%)	86 (92.4%)	93 (100%)
<i>Silicone Oil (Pyrethroid control)</i>	20 (1)	0 (0%)	0 (0%)	0 (0%)
<i>Olive Oil (OP/carbamate control)</i>	20 (2)	0 (0%)	0 (0%)	0 (0%)
<i>Risella Oil (OC control)</i>	20 (1)	0%	0 (0%)	0 (0%)

7.3.6 MATABELELAND SOUTH

For Matabeleland South, the *An. gambiae* s.l was fully susceptible to carbamates and organophosphates, and pyrethroids (Etofenprox). Possible resistance was noted for DDT. Full resistance was noted for pyrethroids (Lambdacyhalothrin), and noted some resistance to DDT and pyrethroids. Table 26, denotes results from susceptibility testing completed in Matabeleland South.

TABLE 26: MORTALITY RATES OF ANOPHELES GAMBIAE FIELD POPULATIONS AT MAKAVHULE (MATABELELAND SOUTH PROVINCE)

Insecticide	Makavhule (Matabeleland South)			
	Total tested (replicates)	KD after 30 min (%)	KD after 60 min (%)	% mortality 24-hour
Lambdacyhalothrin (0.05%)	113 (5)	68 (60.17%)	105 (92.92%)	97 (85.84%)
Etofenprox (0.5%)	50 (2)	39 (78%)	50 (100%)	49 (98%)
Bendiocarb (0.1%)	82 (4)	64 (78.04%)	81 (98.78%)	82 (100%)
DDT (4%)	207 (9)	23 (11.11%)	147 (71.01%)	189 (91.30%)
Pirimiphos methyl (1.0%)	100 (4)	1 (1%)	3 (3%)	100 (100%)
<i>Silicone Oil (Pyrethroid control)</i>	20 (1)	0 (0%)	0 (0%)	2 (10%)
<i>Olive Oil (OP/carbamate control)</i>	20 (1)	0 (0%)	0 (0%)	2 (10%)
<i>Risella Oil (OC control)</i>	60 (3)	0 (0%)	0 (0%)	3 (5%)

7.3.7 MIDLANDS

For Midlands, *An. gambiae* s.l was fully susceptible to all insecticide classes, as noted by a 100% mortality rate for Lambdacyhalothrin, Deltamethrin, Bendiocarb, DDT and Pirimiphos-methyl. Table 27, denotes results from susceptibility testing completed in Midlands.

TABLE 27: MORTALITY RATES OF ANOPHELES GAMBIAE FIELD POPULATIONS AT KAMHORORO (MIDLANDS PROVINCE)

Insecticide	Kamhororo (Midlands)			
	Total tested (replicates)	KD after 30 min (%)	KD after 60 min (%)	% mortality 24-hour
Lambdacyhalothrin (0.05%)	92 (5)	91 (91.92%)	91 (98.91%)	92 (100%)
Deltamethrin (0.05%)	67 (3)	54 (80.59%)	67 (100%)	67 (100%)
Bendiocarb (0.1%)	98 (5)	97 (98.97%)	98 (100%)	98 (100%)
DDT (4%)	99 (5)	62 (62.62%)	98 (98.98%)	99 (100%)
Pirimiphos-methyl (1.0%)	110 (5)	27 (24.54%)	108 (98.18%)	110 (100%)
<i>Silicone Oil (Pyrethroid control)</i>	20 (1)	0 (0%)	0 (0%)	0 (0%)

7.3.8 MASVINGO

For Masvingo, *An. gambiae* s.l was fully susceptible to all insecticide classes, as noted by a 100% mortality rate for all four insecticide classes. Table 28, denotes results from susceptibility testing completed in Masvingo in April.

TABLE 28: MORTALITY RATES OF ANOPHELES GAMBIAE FIELD POPULATIONS AT KAMHORORO (MIDLANDS PROVINCE)

Insecticide	Kamhororo (Midlands)			
	Total tested (replicates)	KD after 30 min (%)	KD after 60 min (%)	% mortality 24-hour
Lambdacyhalothrin (0.05%)	102(4)	70 (68.6%)	99 (97.1%)	102 (100%)
Etofenprox (0.5%)	24 (1)	19 (82.6%)	23 (95.8%)	24 (100%)
Bendiocarb (0.1%)	48 (2)	32 (66.7%)	48 (100%)	48 (100%)
DDT (4%)	106 (4)	48 (45.3%)	92 (86.8%)	106 (100%)
Pirimiphos-methyl (1.0%)	95 (4)	22 (23.2%)	69 (72.6%)	95 (100%)
<i>Silicone Oil (Pyrethroid control)</i>	24 (1)	0 (0%)	0 (0%)	0 (0%)
<i>Olive oil (OP/Carbamate control)</i>	24 (1)	0 (0%)	0 (0%)	0 (0%)
<i>Risella oil (OC control)</i>	25 (1)	0 (0%)	0 (0%)	0 (0%)

7.4 MOSQUITO COLLECTION

Data regarding mosquito behavior and density was collected on a monthly basis from September 2013 through March, 2014 in Burma Valley and Chabwino Farms (control site). For Kawere and Kasimure sentinel sites, data was collected in September, 2013, and November 2013 through March 2014. Final mosquito collection will be completed at all sentinel sites in late April, 2014. Unfortunately, due to low mosquito collections surrounding the two sentinel sites, and a family issue for an AIRS Zimbabwe entomological staff member, pyrethrum spray collection and CDC light trap work were not completed at Kawere and Kasimure in October.

7.4.1 PYRETHRUM SPRAY COLLECTION

Pyrethrum spray collections were done at Kasimure, Burma Valley, and Kawere sentinel sites, and the control site at Chabwino Farm, to note the indoor resting densities of mosquitoes. Generally, few mosquitoes were collected at Kasimure, Kawere, and at Chabwino Farm. Significantly more mosquitoes were collected at Burma Valley. The total number of mosquitoes and their gonothrophic stages are summarized in table 29. AIRS Zimbabwe notes the important factors associated with the pyrethrum spray collections in the bullets below:

- An. funestus was 16 times more abundant than An. gambiae in Burma Valley, suggesting that An. funestus is the main malaria vector in the area.
 - Five months after spraying, the number of An. funestus collected, peaked at 60. Given the residual efficacy data, and the susceptibility data listed in this report for Burma Valley, it may note that five months after spraying, the insecticide has limited impact on the vector mosquitoes around Burma Valley.
- An. funestus was not observed resting indoors at Kawere, Kasimure and Chabwino Farm. The absence of this species at three sentinel sites suggests limited availability of suitable breeding habitats in these areas.
 - More tests are needed to confirm these initial observations. An. funestus consists of several species that cannot be distinguished morphologically. Therefore, a better understanding of the vector will be determined after the specimens have been analyzed to species level at NIHR.
- An. gambiae s.l. was found in low densities at all four sentinel sites. An. gambiae s.l. densities were low even prior to spraying. The species was scarce even at the control site, Chabwino Farm, suggesting limited availability of suitable breeding habitats.

TABLE 29: INDOOR RESTING MOSQUITOES FROM PYRETHRUM SPRAY COLLECTIONS

Sentinel site	Species	Date of collection	Unfed	Fed	Half gravid	Gravid	Total	Number of Rooms	Density
Burma Valley (Sprayed)	An. gambiae	September	0	1	0	0	1	12	0.08
		October	0	0	0	0	0	12	0
		November	2	0	0	0	2	12	0.16
		December	2	0	0	0	2	12	0.16
		January	0	0	1	1	2	12	0.16
		February	1	1	0	0	2	12	0.16
		March	0	0	0	0	0	12	0
		Total	5	2	1	1	9	84	0.10
	An. funestus	September	4	9	0	0	13	12	1.08
		October	0	1	0	0	1	12	0.08
		November	0	1	0	0	1	12	0.08
		December	1	11	1	3	16	12	1.33
		January	1	6	0	1	8	12	0.66
		February	17	36	5	2	60	12	5.00
		March	13	17	3	4	37	12	3.08
Total		36	81	9	10	136	84	1.61	
Kawere (Sprayed)	An. gambiae	September	0	0	0	0	0	12	0
		October	Not completed						
		November	0	0	0	0	0	12	0
		December	0	0	0	0	0	12	0
		January	0	0	0	0	0	12	0

Sentinel site	Species	Date of collection	Unfed	Fed	Half gravid	Gravid	Total	Number of Rooms	Density	
		February	0	0	0	0	0	12	0	
		March	0	1	0	0	1	12	0.08	
		Total	0	1	0	0	1	72	0.01	
Kasimure (Sprayed)	An. gambiae	September	0	1	0	0	1	12	0.08	
		October	Not Collected							
		November	0	1	0	0	1	12	0.08	
		December	0	0	0	0	0	12	0	
		January	0	0	0	0	0	12	0	
		February	0	0	0	0	0	12	0	
		March	Not completed as of submission of End of Spray Report							0
		Total	0	2	0	0	2	60	0.03	
Chabwino Farm (Control)	An. gambiae	September	0	0	0	0	0	12	0	
		October	0	0	0	0	0	12	0	
		November	0	0	0	0	0	12	0	
		December	2	2	0	0	4	12	0.33	
		January	0	2	0	0	2	12	0.16	
		February	0	2	0	0	2	12	0.16	
		March	Not completed as of submission of End of Spray Report							
	Total	2	6	0	0	8	72	0.11		
	An. funestus	September	0	0	0	0	0	12	0	
		October	0	0	0	0	0	12	0	
		November	0	0	0	0	0	12	0	
December		0	0	0	0	0	12	0		

Sentinel site	Species	Date of collection	Unfed	Fed	Half gravid	Gravid	Total	Number of Rooms	Density
		January	0	0	0	0	0	12	0
		February	0	0	0	0	0	12	0
		March	Not completed as of submission of End of Spray Report						
		Total	0	0	0	0	0	72	0

7.4.2 MOSQUITO COLLECTED FROM CDC LIGHT TRAPS

CDC light traps were used for mosquito collections at Kasimure, Burma Valley, and Kawere sentinel sites, and the control site, Chabwino Farm. Overall, indoor and outdoor densities were low, before, during and after the IRS campaign. Listed below is a summary of the results of the CDC Light Traps:

- *An. funestus* was found to have a higher density indoors than outdoors at Burma Valley. This suggests endophagic behavior for vector species in Manicaland.
- *An. gambiae* was found to have a slightly higher density indoors than outdoors in Kawere. This suggests possible endophagic behavior for vector species in Mashonaland East.
- *An. gambiae* was found to have slightly higher density outdoors than indoors in Kasimure. This suggests possible exophagic behavior for vector species in Mashonaland West.
- Neither vector species was found inside in Chabwino Farm, suggesting exophagic behavior for vector species at the control site.

Please note the results of the CDC Light Traps in Table 30.

TABLE 30: INDOOR RESTING MOSQUITOES FROM PYRETHRUM SPRAY COLLECTIONS

Sentinel site	Month	Position	No. of traps	An. gambiae	Density	An. funestus	Density	
Burma Valley (Sprayed)	September	Indoor	6	0	0	34	5.66	
		Outdoor	6	0	0	46	7.66	
	October	Indoor	6	0	0	13	2.16	
		Outdoor	6	0	0	15	2.50	
	November	Indoor	6	0	0	17	2.83	
		Outdoor	6	0	0	21	3.50	
	December	Indoor	6	0	0	23	3.83	
		Outdoor	6	0	0	3	0.50	
	January	Indoor	6	21	3.5	0	0	
		Outdoor	6	4	0.66	7	1.16	
	February	Indoor	6	0	0	1	0.16	
		Outdoor	6	0	0	0	0	
	March	Indoor	6	0	0	109	18.16	
		Outdoor	6	0	0	18	3.00	
Totals	Indoor		42	21	0.5	197	4.69	
	Outdoor		42	4	0.09	110	2.61	
Kawere (Sprayed)	September	Indoor	6	0	0			
		Outdoor	6	0	0			
	October	Indoor	Not Collected					
		Outdoor						
	November	Indoor	6	0	0			
		Outdoor	6	0	0			
	December	Indoor	6	1	0.16			
		Outdoor	6	0	0			
	January	Indoor	6	0	0			
		Outdoor	6	0	0			
	February	Indoor	6	1	0.16			
		Outdoor	6	0	0			
	March	Indoor	6	4	0.66			
		Outdoor	6	4	0.66			
Totals	Indoor		42	6	0.14			
	Outdoor		42	4	0.09			

Sentinel site	Month	Position	No. of traps	An. gambiae	Density	An. funestus	Density		
Kasimure (Sprayed)	September	Indoor	6	0	0				
		Outdoor	6	2	0.33				
	October	Indoor	Not Collected						
		Outdoor							
	November	Indoor	6	1	0.16				
		Outdoor	6	1	0.16				
	December	Indoor	6	0	0				
		Outdoor	6	0	0				
	January	Indoor	6	0	0				
		Outdoor	6	0	0				
	February	Indoor	6	0	0				
		Outdoor	6	0	0				
	March	Indoor	6	0	0				
		Outdoor	6	0	0				
Totals	Indoor	42	1	0.16					
	Outdoor	42	3	0.50					
Chabwino Farm (Control)	September	Indoor	6	0	0	0	0		
		Outdoor	6	1	0.16	7	1.16		
	October	Indoor	6	0	0	0	0		
		Outdoor	6	1	0	7	1.16		
	November	Indoor	6	0	0	0	0		
		Outdoor	6	0	0	0	0		
	December	Indoor	6	0	0	0	0		
		Outdoor	6	0	0	0	0		
	January	Indoor	6	0	0	0	0		
		Outdoor	6	0	0	0	0		
	February	Indoor	6	0	0	0	0		
		Outdoor	6	0	0	0	0		
	March	Indoor	Did not complete CDC Light Traps for March, as of submission of this report						
		Outdoor							
Total	Indoor	42	0	0	0	0	0		
	Outdoor	42	2	0.04	14	0.33			

7.5 SENTINEL SITE ASSESSMENT

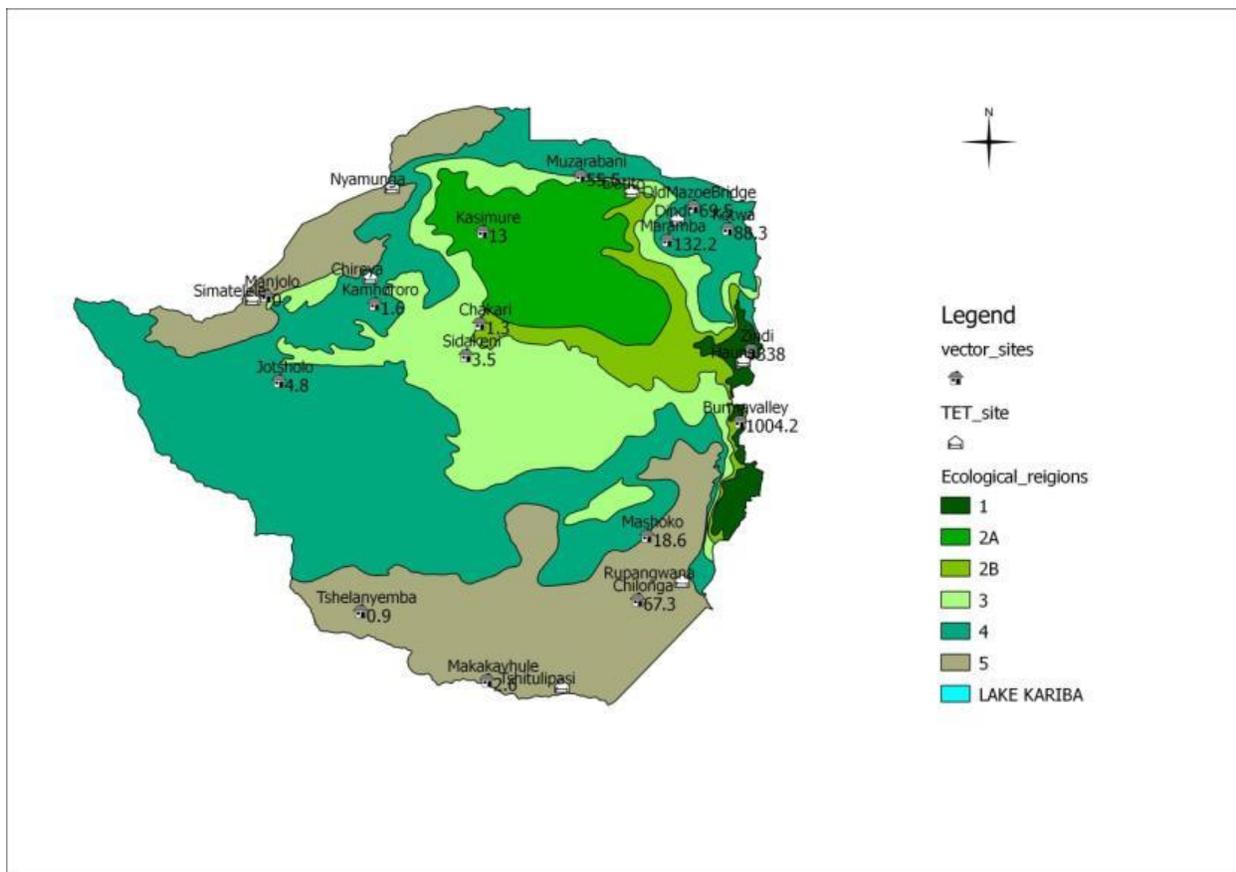
All 16 government entomological sentinel sites and eight therapeutic efficacy testing (TET) sites were assessed in February to determine (1) the appropriateness of the location of the sites collecting entomological surveillance data, (2) the functionality of the sites, (3) the resource needs of the surveillance sites, and (3) the possibility of combining existing TET sites with the sentinel sites. Three teams consisting of staff from AIRS Zimbabwe, WHO, NMCP, NIHR, CDC-Atlanta, and MOHCC participated in the assessment. The assessment involved site visits, where a checklist and questionnaire (approved by all stakeholders during the final planning for the assessment in early February) were used to collect relevant data. A database was developed in Microsoft Access, with AIRS Zimbabwe staff working with the other stakeholders to analyze the data via Epi Info version 3.5.1. As of the submission of this report, the initial draft version of the sentinel site assessment report is currently being reviewed internally. The report should be ready by early May, 2014.

AIRS Zimbabwe also hired a Zimbabwean entomological consultant based in South Africa, to lead one of the sentinel site assessment teams, and to help draft the sentinel site assessment report.

The assessment teams also visited Zimbabwe's two national entomological laboratories (the main NIHR laboratory in Harare, and the De Beers Research Laboratory in Chiredzi) to also evaluate their conditions and identify their resource needs to complement vector surveillance efforts.

Figure 13, below denotes the location of the sentinel sites and TET sites visited during the assessment, their ecological region (based on mean annual rainfall) and malaria incidence.

FIGURE 13: LOCATION OF SENTINEL SITES AND TET SITES ASSESSED DURING THE SENTINEL SITE ASSESSMENT



Please find listed below the initial findings and recommendations of the assessment:

Initial findings

1. Some of the sentinel sites are found in the same ecological and epidemiological regions, and receive the same vector control interventions. The data collected from such sites may be similar, creating the issue of possible duplication of data collected, and waste of resources in maintaining both sites.
2. All 16 insectaries do not meet the recommended structural standards of a field insectary. Numerous sites lack electricity and thereby do not have the correct lighting or air-conditioners to help with mosquito breeding.
3. There is inadequate equipment and supplies for collecting and processing mosquitoes at most of the sentinel sites.
4. Insectary managers are not full-time positions at the sentinel sites. Instead, these are part-time positions, with the insectary managers focusing more time on other health activities (i.e., communication work concerning cholera, water and sanitation, and other health issues). Given that the insectary managers have other responsibilities, this may impact how much time they have to collect and rear mosquitoes for entomological surveillance work.
5. The knowledge and skills of insectary managers are underutilized due to inadequate equipment and supplies.

6. The NIHR laboratory in Harare has adequate structural facilities to provide entomological support and is currently the only laboratory conducting the testing of mosquitoes for the national malaria vector surveillance program
7. The De Beers Laboratory in Chiredzi has ample facilities to provide entomological support, but is currently being underutilized.

Initial Recommendations

1. The NMCP and malaria partners should revise the location of some sites to avoid duplication of entomological data collection, and/or possibly reduce the redundant sentinel sites to save budgetary costs.
 - a. It is definitely possible to combine the sentinel sites with TET sites, to avoid duplication in data collection.
2. The NMCP and malaria partners should rehabilitate and equip all insectaries to make them suitable for vector surveillance.
3. Additionally funding needs to increase at the NIHR to help procure needed and updated equipment and resources to boost capacity.
4. The NIHR/NMCP needs to develop a plan to increase the use of the De Beers laboratory for entomological surveillance, and further increase the capacity for entomological surveillance in-country.

7.6 DEVELOPMENT OF A SUSCEPTIBLE COLONY IN ZIMBABWE

The NIHR could not provide mosquitoes from its susceptible colony for entomological surveillance work during the 2012 IRS campaign due to the low population of the colony. To remedy this issue, PMI and AIRS Zimbabwe worked to improve the insectary management capacity of the NIHR, including trainings on insectary management and rearing a susceptible colony during the CDC-led entomological training (please see section 3.3.1.1. “Support for PMI-led Zimbabwe Entomological Training). Before this training started, AIRS Zimbabwe also worked with the managers of the DeBeers Laboratory to replace old equipment and refurbish their insectary. AIRS Zimbabwe also supported the refurbishments of the NIHR’s insectary in Harare, to ensure it was functioning properly. The AIRS Zimbabwe Technical Director/Entomologist also provided technical support to the insectary in Harare, through regular visits.

AIRS Zimbabwe hoped that a susceptible colony would be available by the start of the 2013 IRS campaign given the refurbished insectaries and the susceptible mosquito colony eggs provided by the CDC at the end of the PMI training. However, the susceptible colony that was established in Harare was only able to provide enough mosquitoes for Manicaland’s first bioassay testing in October. The colony struggled to sustain adult mosquitoes, and eventually collapsed in November. AIRS Zimbabwe believes the colony may have collapsed for the following reasons:

- The colony needs a sustained supply of distilled water, instead of the filtered water that the NIHR originally began using. When distilled water was provided by the University of Zimbabwe for a short time period, the colony was able to produce more adults.
- The insectary in Harare was re-painted in November, and when the colony was moved to an adjacent “snail room” the conditions were not favorable (lighting and heat) leading to a decrease in the colony size.
- When the colony was returned to the insectary room, due to poor ventilation in the room, the paint fumes were still lingering and may have further impacted the colony.

The CDC sent a new batch of sustainable colony eggs to Zimbabwe in late –March, 2014. The eggs were hatched at the DeBeer’s Laboratory insectary, and have reached adult stage. Additionally, the eggs were hatched at the NIHR Laboratory in Harare, which has also reached adult stage, however the overall colony population in Harare has since decreased sharply. AIRS Zimbabwe will continue to monitor the situation, and hopes the colonies can continue, and may be used for future entomological surveillance activities.

AIRS Zimbabwe is also in the process of securing mosquito eggs from South Africa that could be used for furthering the population of the sustainable colonies in Chiredzi and Harare. However, the insectary in Harare needs to be further inspected before this is possible.

7.7 CONSTRAINTS FOR ENTOMOLOGICAL SURVEILLANCE WORK

- During entomological surveillance, the AIRS Zimbabwe Technical Director/Entomologist, Entomological Assistant and insectary managers encountered problems getting enough mosquitoes, especially larvae and pupae, for insecticide resistance monitoring. This occurred at Chabwino Farm, Burma Valley, Kawere, and Kasimure sentinel sites in particular. Initially, the scarcity of mosquitoes was due to the dry weather conditions, but later the unusually heavy rains this year have flushed breeding sites.
- Since the NIHR could not provide a susceptible colony of mosquitoes for use during the bioassay tests and other entomological monitoring activities, the AIRS Zimbabwe Entomologist trained mosquito collectors and the Insectary Manager at the Kamhororo sentinel site in Gokwe South District to collect and rear wild *An. gambiae* mosquitoes for entomological surveillance work. This sentinel site was selected since nearby artesian wells tend to over flow and create good conditions for mosquito breeding. The Insectary Manager and mosquito collectors managed to raise enough mosquitoes to satisfy demand until March, when the breeding sites were flooded following incessant rains. This has led to delays in finishing the susceptibility testing.

8. POST-SPRAY REVIEW MEETINGS

All seven provinces which used pyrethroids during 2013/14 IRS campaign, successfully conducted post-spray review meetings in February and March, 2014. A national IRS review is planned for May. Dates are currently being developed by the NMCP. Post-spray review meeting participants included provincial and district health staff, and NMCP personnel. Since most of the meetings occurred during the same week (March 23-27), AIRS Zimbabwe staff were only able to attend the post-review meetings in Mashonaland Central (their post-spray review meeting took place in February), Mashonaland East, and Manicaland.

The main focus of the meetings was to share final data from the IRS campaign, note key information from IRS campaign implementation, and review IRS campaign challenges and discuss possible solutions. Participants also discussed plans for the 2014 IRS campaign. Listed below are some of the key points stated during the provincial post-spray review meetings:

- Health staff were dissatisfied with the current monitoring and evaluation systems (using the Frontline SMS system) for IRS, and felt the IRS campaign data was shared with them too late, long after various communities had been sprayed;
- Districts and provinces admitted that they released PPE and insecticide to the spray teams too late, right before spraying began, which led to some delays for spray teams to organize themselves and start spraying on-time;
- Camping equipment, sprayer pumps, lorries, and motorcycles are in poor shape, and due to their unreliability and break-downs led to delays;
- There is a need to review IRS allowances for both spray operators and supervisors. Spray operators are dissatisfied with their daily rate, and have regularly asked for an increase;
- Entomological data is limited in most provinces, and gaining more entomological data will help significantly with IRS campaign planning;
- Further environmental compliance capacity building for IRS campaign staff would be helpful;
- There is a need to improve the storage of insecticides at the provincial-level;
- There is a need for a permanent IRS coordinator at the district level to ensure continuity with IRS planning and capacity building throughout the year, similar to what has been adopted for tuberculosis programing;

Key recommendations that the provincial review meeting participants developed, included:

- Provinces should try and improve the accuracy of quantification efforts for forecasting insecticide needs for the 2014 IRS campaign;
- A national review of IRS campaign allowances and daily rates should be completed as soon as possible;
 - Currently the NMCP is recommending daily rates for spray operators increase to \$15 a day, pending availability of funds for spray operators during the 2014 IRS campaign.
- IRS managers should be trained in vector surveillance;
- There is need for partners to assist provinces with the servicing of four land cruisers and motor cycles used for IRS supervision and mobilization;

- The provinces would like to receive further environmental compliance training to re-enforce key issues and messages;
- Standards for storing insecticides should be established;
- Assuring better entomological data is available in each province, especially the distribution of vector species, resting and biting behavior of vector species, as well as insecticide susceptibility status of the vector mosquitoes in the provinces;
- There is a need for re-stratification of malaria transmission zones in the provinces;
- The Frontline SMS system should be redeveloped to assure greater transparency and speed-up when district and provincial staff have access to the data;

9. LESSONS LEARNED, CHALLENGES AND RECOMMENDATIONS

Listed below are the lessons learned and challenges that AIRS Zimbabwe noted from its project implementation in support of the 2013 IRS campaign. Additionally, AIRS Zimbabwe has listed several recommended actions to improve IRS campaign implementation in future years.

9.1 LESSONS LEARNED/CHALLENGES

- **Support for PMI and non-PMI Supported Districts**

AIRS Zimbabwe noted a sharp contrast with respect to the PPE used by the spray operators based in pyrethroid districts versus those in DDT districts. Spray teams based in DDT districts were at greater risk to insecticide exposure due to less adequate PPE as compared to spray teams in pyrethroid districts. In addition, the NMCP has noted that pyrethroid districts benefitted from first aid, spray pump maintenance, and other trainings that were not provided to the DDT district spray personnel. AIRS acknowledges that this is a difficult issue, since a lack of an SEA in place to support DDT prevents support for the other 22 districts that spray with DDT.

- **Supervision of IRS Campaign**

The smartphone proved to be very useful for IRS campaign data collection and monitoring. AIRS Zimbabwe collected significantly more data during the 2013 IRS campaign than was collected in last year's campaign. However, AIRS Zimbabwe encountered challenges in using the smartphone. Specifically, the electronic checklist requires the user to record GPS coordinates for the purposes of staff accountability and locating soak pits, store rooms, etc. Depending on the satellite location, it could take anywhere from 3 to 30 minutes to collect the GPS data. Additionally, using a touchscreen phones (i.e., smartphone) was a brand new tool for one consultant and, even after extensive training, the staff member was unable to use the phone. Consequently, the consultant collected the necessary data by paper and an AIRS staff person entered into the environmental compliance database. In the future, AIRS will make sure all staff and consultants are able to use the smartphones, as this will save the project considerable level of effort.

Should AIRS Zimbabwe move forward with piloting the use of electronic checklists by more IRS campaign staff during future IRS campaigns, the project will need to assure the checklists are available on more familiar technology (such as more common non-smartphone, mobile phones). Additionally the project will need to provide thorough training on using the checklists on mobile phones, and provide IT support.

- **Planning/Collaboration for IRS Activities**

It helped to involve the NMCP, NIHR, and other key stakeholders in the development of the AIRS Zimbabwe work plan by allaying misconceptions and avoiding any delayed activities due to the need to gain stakeholder buy-in. Additionally, regular communication and engagement with NMCP, NIHR and PMI ensured the project goals, objectives, and activities were understood, and assistance could be

provided to facilitate on time IRS activity. This also helped AIRS Zimbabwe retain project visibility and develop connections with various stakeholders. AIRS Zimbabwe has worked hard to build trust with the NMCP, NIHR, and provincial and district officials, which has resulted in good collaboration, and the stakeholders being more receptive to various capacity-building and IRS campaign changes, such as the use of soak pits throughout all pyrethroid districts in 2013. Even though AIRS Zimbabwe will be shrinking the geographic area of its support for the 2014 IRS campaign, the project will need to continue to maintain these important relationships.

Nonetheless, stakeholder sensitivity to various IRS campaign issues and policies needs to continue to be considered during future technical assistance activities. As noted during the past project year, several activities such as the sentinel site assessment and incinerator evaluation were delayed until further discussion and input could be gained from various stakeholders. Other activities such as completing an updated SEA to include DDT were turned down by the NMCP due to various IRS campaign priorities and different IRS campaign policies.

- **New Staff Positions**

AIRS Zimbabwe benefitted greatly from adding the new staff members, as all of them helped adequately expand project activities to all 25 pyrethroid districts, and allowed for extending entomological surveillance and national susceptibility testing. Additionally, as noted in section 2.2.1, “Hiring of IRS Technical Officer,” the IRS Technical Officer played a key role in establishing AIRS Zimbabwe’s relationship with provincial and district health offices. This will help greatly with AIRS Zimbabwe’s new scope of work and implementing IRS in Manicaland.

- **Environmental Compliance**

As a result of intensive and sustained communication, education, and advocacy efforts with NMCP and MOHCC staff at provincial and district levels, acceptance and approval of IRS environmental compliance/safety activities continues to grow. The NMCP is fully cognizant that environmental safety is an issue where the national IRS program can improve, and has continued to seek the support of PMI and AIRS regarding this issue. EMA and the EHD have also expressed a strong interest in working with AIRS Zimbabwe to improve IRS environmental safety, and develop new policies and standards for IRS. AIRS Zimbabwe, under PMI’s direction, is positioned to update IRS campaign standards during the current drafting of the new malaria strategic plan, as needed.

- **Entomological Surveillance Assistant**

Regarding entomology, AIRS Zimbabwe has built a good working relationship with the NIHR. This has benefitted AIRS Zimbabwe, via the NIHR’s ability to now complete molecular analysis, and with some further assistance, the NIHR will be prepared to provide susceptible colonies of mosquitoes. AIRS Zimbabwe definitely realizes the value of this relationship and should continue to work to build the NIHR’s capacity.

- **IRS Campaign Implementation**

Storage facilities are a significant issue from the campsite- to the provincial-level. Significant issues exist ranging from poor security (i.e., no onsite guards, storing insecticides in unlocked tents, etc.), to a lack of thermometers. Resources are needed to help refurbish and upgrade storage facilities, including the construction of pallets, better lighting, and ensuring insecticides are stored separately from other health commodities. At the campsite, tents need to be replaced and storage bins provided to the spray teams.

Spray personnel continually expressed their dissatisfaction with the IRS campaign payment system. Spray personnel in all districts requested a higher daily rate (spray operators) and per diem rates (IRS campaign supervisors). Spray operators were also upset about receiving their pay 2 to 3 days late (as

payments needed to be transferred from the NMCP bank accounts through provincial and district bank accounts, before they could be issued for payment). Since spray operators are paid on the first day of their one-week break, the delay in payment often led to spray operators needing to stay at their camp sites for extra days, and having less time to spend during their break in their home community. In turn this led to lower motivation among spray operators to continue their work after the break ended.

- **Issues with Importation Duties**

Although AIRS Zimbabwe was able to procure a project vehicle in 2013, the project was unable to use the vehicle because of the current importation and duty issues with the ZIMRA. This has led AIRS Zimbabwe to continue to rent vehicles or take taxis to complete the project work. Transportation continues to be a significant cost for project implementation.

AIRS Zimbabwe also had importation and duty issues with ZIMRA when internationally procured items arrived in Harare. Once more ZIMRA pushed for AIRS Zimbabwe and USAID to pay for importation duties for the items, and did not recognize past agreements between USAID and the Zimbabwean government to waive importation duties for international development project items.

9.2 RECOMMENDATIONS

1. AIRS Zimbabwe noted that the main opportunities to present on environmental and entomological issues are at the levels 1 and 2 trainings, since the trainings are attended by a high number of NMCP and provincial and district health officials. However, the levels 1 and 2 trainings are very busy and any presentations by AIRS staff must be brief; thus, there is not enough time to go into details. It's important to note that key environmental compliance and entomological surveillance issues (i.e., mandating the use of soak pits, ensuring the development of a susceptible mosquito colony, etc.), would gain a lot of mileage and ensure more sustainability if they were included in a revised IRS training curricula. The current curricula were updated ten years ago. For this reason, AIRS Zimbabwe recommends helping the NMCP update the training curriculum to include better information on environmental compliance and entomological surveillance.
2. The completion of an environmental compliance training by AIRS Zimbabwe focusing on storing insecticides and IRS campaign equipment would be useful. This training may help government stakeholders understand the risks to the condition and viability of the insecticides and PPE with regards to how they are currently stored, and the potential for theft. The training could also provide ideas of how to improve storage of insecticides and PPE, particularly at the camp site-level, where the use of a large and lockable plastic bin could securely store items. AIRS Zimbabwe has already spoken with various plastic distributors in Harare to determine the viability of procuring several bins for next year's IRS campaign.
3. There is strong potential for the expanded use of mobile technology in Zimbabwe for IRS campaign activities that should be explored. Zimbabwe has consistent mobile phone network coverage and a higher than average capacity of IT and mobile technology capacity among in-country staff. As noted during the 2013 IRS campaign, mobile technology was used by the IRS campaign staff for collecting spray campaign coverage data and sending it to the NMCP. Further training of NMCP and provincial and district health staff in mobile technology may help develop other uses for mobile phones for IRS, including their use in IEC/mobilization for IRS beneficiaries, and tracking IRS campaign equipment and insecticide stock.
4. AIRS Zimbabwe supports improved advocacy with political, religious, and community leaders in IRS operational areas, in order to boost support and acceptance of IRS. While spray coverage

rates were over 91% in 2013, efforts should be made to increase the coverage rate even higher. This should be supported with extensive meetings with community members and household owners supported by mass media communications and facility- and community-based health workers before, during, and after IRS. This calls for increased investment in IRS message and material development and tools to strengthen social and behavior change communication.

5. Since PPE remains a large annual cost for completing IRS annually, the NMCP should work to try and re-use as much PPE as possible from one year to the next. It would be advisable to improve supervision on the use of PPE to ensure it is not unnecessarily damaged. While the NMCP has adopted a policy of collecting as much PPE as possible after the IRS campaigns, the enforcement of this policy needs to improve.
6. In addition to retaining as much PPE as possible, the NMCP should also complete an extensive review of all PPE and IRS commodities in stock, and record their condition. From the inventory list, the NMCP can start working with donors, such as PMI and the Global Fund, to develop a multi-year plan to replace damaged and unusable IRS materials (i.e., spray pumps). If planned correctly, given that donors are unlikely to replace all PPE and IRS materials in one year, within a few years, the Zimbabwe IRS program could have replaced its entire IRS campaign material inventory. Further, the NMCP should build from this inventory list and keep track of when spray pumps, tents, barrels, etc., will likely reach the end of their recommended usage period.
7. AIRS should engage the NMCP in discussions about gaining more efficiency during the IRS campaigns, particularly by shortening the length of the IRS campaign. AIRS has found that the IRS campaign in Zimbabwe takes longer than other IRS programs in Africa, and given the good infrastructure in Zimbabwe and the highly experienced full-time and seasonal IRS staff, it may be possible to decrease the number of days needed to complete IRS. This in-turn could provide for cost-savings for future IRS campaign budgets. For example, eliminating the national IRS campaign policy of having a one week break at the end of every three weeks of spraying could decrease the length of the IRS campaign significantly. Alternatively, by requiring spray operators to spray two or three more structures daily, the number of days needed for the IRS campaign would also likely decrease. An additional benefit to a shorter spray campaign would be less wear and tear on IRS equipment and PPE, which may allow more IRS equipment and PPE to be re-used during future IRS campaigns, and limit procurement line items in future IRS campaign budgets.
8. Assurance and enforcement that pregnancy tests are completed for 100% of all women working on spray teams is strongly needed for future IRS campaigns. AIRS Zimbabwe was surprised to find that 31% of all spray areas observed had not administered pregnancy tests (see section 5.4.2, "Pre-Spray Poison Control and Health Observations) for female IRS campaign staff that is within the proximity of insecticides. Given the substantial risks of not completing pregnancy tests, AIRS Zimbabwe will present on the importance and need of pregnancy tests during levels 1, 2, and 3 trainings, work with the NMCP to assure pregnancy testing is included in all training curriculum, and is a standard for all IRS programming. For the 2014 IRS campaign, AIRS Zimbabwe will make certain that pregnancy tests are completed one-week before the spray campaign begins, and 30 days after the spray campaign has started, as noted in the BMP. AIRS Zimbabwe will also abide by current policy of the AIRS project, that any women that do test positive on the pregnancy test, will be allowed to continue work on the IRS campaign, however they will be assigned to various positions that are not in close proximity to insecticides (such as warners, or assisting with data entry).

9. Although the NMCP is already looking into ideas for improving the transparency and timeliness of data reporting to district and provincial –level IRS staff, it would be advisable to develop a district or provincial level database, to allow IRS staff to understand the number of structures that were sprayed each day, and track daily progress against the proposed IRS schedule. For all databases that could be developed, this would require daily IRS campaign data to be transferred to an IRS staff member who could enter the data into a platform, or the use of advanced data platforms that can automatically compile and organize data. Thereafter district and provincial IRS staff members should be able to contact an IRS staff member to make queries, or have access to the database to view the IRS campaign data, and track data for the number of structures sprayed at any given time against the proposed IRS schedule. This would eliminate the need to wait for an entire week of data to be compiled, organized, and analyzed, before it is made available to IRS staff for understanding spray campaign progress.
- The database could be simple, and rely on the data assistants at each camp site to send a SMS to an IRS staff member at the end of each IRS campaign day with daily spray totals for the communities sprayed. The IRS staff member would then enter the totals into an excel sheet or other tracker form, where daily spray totals would be listed next to the planned spray campaign coverage numbers developed during pre-spray planning sessions.
 - Or the database could be more complex and have IRS spray campaign data forms sent to a data entry center, where seasonal data-entry clerks enter several pieces of data based on spray campaign coverage from that day. The data could include codes that identify each individual structure sprayed to allow tracking spray coverage down to the structure-level for completing more advanced queries. This type of database is commonly used in all AIRS countries to track spray campaign coverage.
 - The AIRS project is currently piloting the use of “Textit” software (www.textit.in) in Benin, for tracking daily spray progress during its 2014 IRS campaign. In Benin one IRS campaign worker per district sends a SMS noting the number of structures sprayed and quantity of insecticide used for each day of the IRS campaign to a specific mobile phone number. Thereafter the Textit software receives and compiles all of the data per district, and automatically sends out a report via email to the AIRS Benin staff noting spray progress against scheduled daily targets (this is displayed in a graph that is automatically updated each day when the data is received via the SMS), and the amount of insecticide used at the end of each day. This platform allows the AIRS Benin staff to quickly identify spray areas that are falling behind schedule, and forecast if insecticide usage rates are on-track to prevent a possible stock-out. This platform could be readily applied in Zimbabwe, using the lessons learned from the current IRS campaign in Benin.
10. AIRS Zimbabwe should consider adding a clause in future OAAs with the MOHCC, to note that the importation of internationally procured items to support IRS campaigns are exempted from customs duties, and the MOHCC can work with AIRS Zimbabwe to assure that imported IRS campaign items are cleared from customs quickly.

10. ANNEX

10.1 OUTLINE OF AGREED ACTIVITIES

OUTLINE OF AGREED ACTIVITIES BETWEEN ABT ASSOCIATES' AFRICA INDOOR RESIDUAL SPRAYING (AIRS) PROJECT AND THE MINISTRY OF HEALTH AND CHILD WELFARE'S NATIONAL MALARIA CONTROL PROGRAMME (NMCP) TO SUPPORT THE 2013 IRS CAMPAIGN

This document is meant to clarify the scope of several key activities that will be undertaken by the Ministry of Health and Child Welfare (MOHCW) through the National Malaria Control Programme (NMCP) and in conjunction with Abt Associates (operating under its project name, the Africa Indoor Residual Spray (AIRS) Zimbabwe project). This document is intended to assure collaboration and support for the 2013 IRS campaign.

The agreed activities are supported by the United State Agency for International Development (USAID)'s President's Malaria Initiative (PMI), and their malaria control program, which is the sole funding agent for the AIRS project. This Outline of Agreed Activities will follow and use as a guide the activities that PMI has developed in its Malaria Operational Plans for 2012-2014, and to the approved 2013-2014 AIRS Zimbabwe work plan, which was reviewed by the NMCP in July, 2013.

AIRS' support for the 2013 IRS campaign will be limited to the 24 districts that complete IRS with pyrethroid-class insecticides in Manicaland, Mashonaland East, Mashonaland West, Mashonaland Central, Midlands, Masvingo, and Matabeleland North provinces. These districts are:

Province	Pyrethroid-spraying Districts Where AIRS Zimbabwe will Provide Support for the 2013 IRS Campaign
Manicaland	Chimanimani, Mutare, Buhera, Mutasa, Makoni, and Nyanga
Mashonaland Central	Shamva, Bindura, Guruve, and Mazowe
Mashonaland East	Mutoko and Murewa
Mashonaland West	Hurungwe, Makonde, Zvimba, Chegutu, Mhondoro-Ngezi and Sanyati
Masvingo	Masvingo, Zaka, Bikita
Matabeleland North	Bubi and Nkayi
Midlands	Kwekwe
Totals	24 districts

1) ACTIVITIES OF AIRS TO SUPPORT THE 2013 IRS CAMPAIGN

The activities of AIRS to support the 2013 IRS campaign shall be to:

- a. provide technical and operations support to the NMCP, especially with regards to environmental compliance and entomological surveillance activities, and other programmatic activities as agreed upon by the NMCP, AIRS Zimbabwe, and PMI.
- b. Assign the Abt Associates employee serving as the AIRS Zimbabwe IRS Technical Officer to the NMCP to assist the Vector Control Officer and other NMCP staff with IRS planning, implementation, training, supportive supervision, documentation and report writing, concerning the 24 districts where pyrethroids will be sprayed during the 2013 IRS campaign
 - i. The AIRS Zimbabwe IRS Technical Officer will work directly with the NMCP, from October, 2013 through January, 2014

1. After January, the AIRS Zimbabwe IRS Technical Officer will resume working directly with the AIRS Zimbabwe team, but will be available for other support activities for the post-IRS campaign activities
 - ii. The AIRS Zimbabwe IRS Technical Officer will remain an Abt Associates employee for all purposes during their assignment with the NMCP, and will be supervised operationally by the AIRS Zimbabwe Project Chief of Party
 - iii. As agreed with the NMCP, the IRS Technical Officer will provide at least 60% of their level of effort to support the work completed by AIRS Zimbabwe regarding IRS campaign monitoring, environmental compliance activities, and entomological surveillance
 - iv. The IRS Technical Officer will coordinate with the Provincial and District health offices for AIRS Zimbabwe staff to access the spray areas in the 24 districts completing IRS with pyrethroids, in order to complete their work.
 - v. The IRS Technical Officer will report to the AIRS Zimbabwe Chief of Party weekly, while working directly under the NMCP Manager who will act as his immediate supervisor during the period he will be assigned to NMCP. The NMCP Manager's supervision will only pertain to the work completed by the IRS Technical Officer for the 24 districts where pyrethroids will be used during IRS.
 - vi. Additionally, Abt Associates will continue to provide any human resources support for the IRS Technical Officer and be responsible for any employment decisions regarding the IRS Technical Officer; however, information will be sought from the NMCP if an issue impacts on the IRS Technical Officer's work during October, 2013-January, 2014.
- c. AIRS Zimbabwe will procure a limited amount of PPE and IRS commodities to support the 2013 IRS campaign, but only for use within the 24 districts that will complete IRS with pyrethroids. As agreed upon in June, 2013 the commodities that AIRS Zimbabwe will provide to the NMCP include:

Item	Total Number to be Procured by AIRS Zimbabwe
Aprons	1,200
Black PVC Sheets(2x2m)	46
Cap	240
Face shields	1,200
First Aid Kits	50
Gasket	390
Gasket Viton	300
Gumshoes	1,200
Hose Clippers	585
Hose Connectors	585
In-Liner Filter	150
Lance	90
Lid Cover Chains	150
Lid Cover (Seal Viton)	300
Mouth/ Nose filters (Face Masks)	74,000
Mutton Cloth (1kg packs)	1,200
Non return valve	150
Nozzle Cap	660
Nozzle Holder	870
Nozzle Tips	1,000

Item	Total Number to be Procured by AIRS Zimbabwe
O-Rings	300
Overalls	2,400
Pressure gauge	450
Progressive Rinsing Drums	100
Pump Cup	300
Pump Cylinder	75
Rubber Gloves (pairs)	1,200
Satchels	1,200
Sealing Ring Viton	240
Spill Kits	95
Soap, liquid (bottles)	1,200
Soap, washing bars	2,400
Soap, washing powder	2,400
Pairs of Socks	2 400
Spring	150
Towels	1,200
Withdrawal Tube	400
Helmets	1,200
Spray Operators and Supervisors Washing Buckets- 20Litre	1,200

- i. AIRS Zimbabwe will be responsible for the direct transport of the procured IRS commodities through the relevant provincial health offices to the district health offices in the targeted 24 districts spraying with pyrethroids.
 1. The Provincial Health Offices will also provide assistance in tracking the location and remaining stock of all IRS commodities provided to the 24 districts spraying with pyrethroids, during and after the IRS campaign.
- ii. AIRS together with NMCP shall monitor the use of the above-mentioned IRS commodities during the 2013 IRS campaign, and document any actions of non-compliance. Thereafter AIRS and the NMCP can participate in immediate training to ensure proper use of the IRS commodities.
- iii. co-label IRS commodities with the PMI and MOHCW logos.
- b. assist with the supervision of the 2013 IRS campaign regarding environmental compliance issues, best practices for spraying rooms, solid and liquid waste disposals, and the completion of spray cards.
 - i. AIRS Zimbabwe will report any issues to the NMCP, MOHCW and PMI, regarding non-compliance or areas that can be improved in the future.
- c. inspect storage facilities checking on environmental compliance, security, maintenance, and repair of IRS equipment (The basis of these inspections will help both partners decide on future commodity needs).
- d. participating in Levels 1 & 2 IRS training, as agreed to between PMI and present on environmental safety issues as well share and synchronise IRS campaign plans for 2013.
- e. Recruit Environmental and Entomological Assistants as well as short term local consultants for entomological surveillance and training and mosquito collection to complement AIRS and NMCP in the support and supervision of spraying

- teams in the provinces, and observe spray operations and environmental compliance for the IRS campaign.
- f. As agreed upon and noted in the 2013-2014 AIRS Zimbabwe work plan, AIRS Zimbabwe will provide construction materials (cement, gum poles, fencing, charcoal, sand, and gravel) required for the establishment of 48 additional soak pits in the 24 districts that will use pyrethroids for its 2013 IRS campaign.
 - i. AIRS Zimbabwe will work with the NMCP, PEHOs, and DEHOs to ensure the construction of soak pits before the 2013 IRS campaign begins in the 24 districts that will use pyrethroids for the 2013 IRS campaign.
 - g. support assessment and refurbishment of incineration facilities for solid waste in in three provinces (Mashonaland East, Mashonaland West, and Manicaland provinces)
 - h. support and conduct a first- aid training for IRS drivers and team leaders
 - i. support a pump/sprayer repair and maintenance training for IRS Field Coordinators in the 24 pyrethroids spraying districts
 - j. monitor environmental compliance before ,during and after the IRS campaign
 - k. support conducting of a post IRS inventory and observe how IRS solid wastes have been collected and stored; check if soak pits were cleaned and locked, and assist if needed, with the incineration of pyrethroid solid wastes from the 24 districts that completed IRS with pyrethroids.
 - l. produce an End of Spray Report, summarizing the results and activities of the IRS campaign. This report will be submitted to NMCP and PMI .
 - m. AIRS Zimbabwe will provide a computer , lap top and printer as well as procure a desk and three chairs for the IRS Technical Officer for use while at NMCP and AIRS Zimbabwe offices
 - n. provide technical support to the NMCP for M&E activities as needed.
 - o. support a three day training for data managers and procure 45 mobile phones and airtime for the data managers to submit their daily data during the 12 weeks of the IRS campaign
 - p. print 500 copies of the NMCP's M&E data collection forms
 - q. conduct entomological surveillance to determine quality of spray; and to also collect data including: susceptibility of local vectors to the insecticides; and monitor vector density and behaviour; in order to provide entomological data to help with insecticide selection decisions for future IRS campaigns;
 - i. work to include
 - r. assist NMCP in building local capacity in entomological activities
 - p. support NIHR laboratories and insectaries in Chiredzi and Harare in order to improve their capacities to produce a susceptible colony of mosquitoes, and their ability to complete entomological surveillance regarding IRS

2) ACTIVITIES OF THE NMCP TO SUPPORT AIRS' ACTIVITIES IN SUPPORT OF THE 2013 IRS CAMPAIGN

The activities of the NMCP to support the AIRS Zimbabwe's work to support the 2013 IRS campaign shall include:

- a. upon the hand-over of the IRS commodities procured by AIRS Zimbabwe (see previous section), take full-responsibility for the use of the commodities, including the safe and appropriate storage, use, and disposal of all commodities

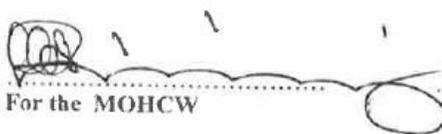
- i. **acknowledge and ensure the IRS commodities procured by AIRS Zimbabwe will only be used in the 24 districts that will complete IRS with pyrethroids**
 - ii. **at the end of the IRS campaign, provide inventory data to AIRS Zimbabwe, including the condition of the commodities provided for the 2013 IRS campaign, and the quantities of each commodity that can be re-used for future IRS campaigns. This data should be provided within 30 days of the end of the IRS campaign.**
- b. **in conjunction with AIRS and PMI, determine the type and quantity of sprayer pump spares and PPE that may need to be procured for supporting IRS campaigns (This shall be done taking into account Abt and USAID procurement requirements),**
 - i. **co-label IRS commodities with the PMI and MOHCW logos**
- c. **provide office space for the IRS Technical Officer, that AIRS Zimbabwe will assign to the NMCP to assist with the management and implementation of the 2013 IRS campaign**
- d. **liaise and work through Provincial and District health authorities to gain clearance and support for the AIRS Zimbabwe staff and the project's consultants to complete activities within the spray areas in their districts/provinces. This will include:**
 - i. **Monitoring of IRS programming (including store rooms, camp sites, and spray teams)**
 - ii. **Building and assuring the completion of soak pits**
 - iii. **Complete entomological surveillance**
 - iv. **Evaluating provincial-level incinerators support work related to analysis and refurbishment of incinerators to meet WHO standards of 1 100-1 300 degrees centigrade**
- e. **ensure that all spray operators comply with policies and regulations for the safe disposal of solid and liquid wastes from the spray campaign, mainly through the use of soak pits and incinerators.**
- f. **enforce the proper use of PPE by spraying teams for compliance with health and safety requirements, and take remedial action for non-compliance.**
- g. **avail AIRS Zimbabwe time to give inputs on environmental compliance and entomological surveillance during levels 1, 2, and 3 trainings on IRS.**
- h. **foster integration of environmental compliance and safety in IRS programmes at all levels**
- i. **collaborate with AIRS Zimbabwe to monitor the implementation of the environmental mitigation and monitoring plan (EMMP), and the requirements of the Environmental Authorities of Zimbabwe.**
- j. **contact Provincial and District health officials to ensure their approval for the building of new soak pits, and that the health officials will ensure the correct maintenance and use of the soak pits for safe disposal of liquid wastes.**
- k. **provide a schedule for the spray campaign to allow Abt Associates Inc. to properly position itself to provide timely support for the 2013 IRS campaign.**
- l. **provide data regarding the progress of the IRS campaigns in the 24 districts spraying with pyrethroids, including the number of rooms sprayed and number of people protected**
 - i. **provide final data on 2013 IRS campaign, chiefly the number of rooms sprayed in each of the 24 districts completing IRS with pyrethroids, and the number of people protected by IRS in the 24 districts**

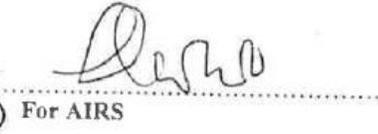
- m. collaborate with AIRS Zimbabwe and NIHR on entomological surveillance in the following areas:
- i. Collection of mosquitoes for use during entomological surveillance activities
 - ii. Provide and facilitate access to sentinel sites for completing entomological surveillance
 - iii. Monitoring vector densities at sentinel sites
 - iv. Monitoring vector susceptibility to insecticides
 - v. Identifying species of *An. gambiae* s.l. collected from sentinel sites. Molecular techniques (PCR) will be used for species identification.

In addition NMCP shall convene or allow for holding of regular meetings with AIRS Zimbabwe project staff, NIHR, PMI and other key stakeholders in the malaria control programme in Zimbabwe to review progress and address challenges being encountered

IN WITNESS WHEREOF, the undersigned, being the duly nominated and authorised representatives of the Parties hereto have agreed to and signed this MOU

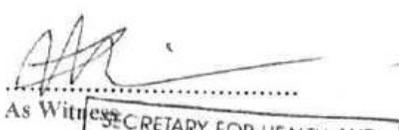
THIS DONE AND SIGNED at Harare on this 11th day of September 2013 in duplicate, in the English language, both texts being equally authentic.

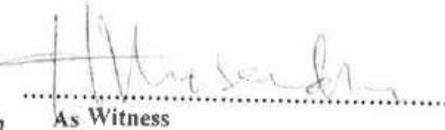

For the MOHCW

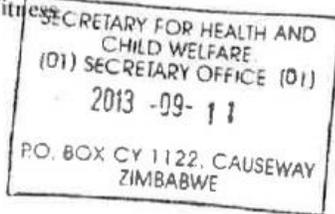

For AIRS

BERNARD GENERAL (D) G. M. T. TINARWO
For the MOHCW (name printed)

G. M. T. TINARWO
For AIRS (name printed)


As Witness


As Witness



10.2 AIRS ZIMBABWE IRS CAMPAIGN MONITORING DATA

Listed below are the fully analyzed checklists completed by the AIRS Zimbabwe team during their monitoring of the 2013 IRS campaign. Please note some questions have been removed from the tables, as the questions did not apply to the IRS campaign in Zimbabwe (for example: questions regarding the use of organophosphate bottles).

10.2.1 PRE-SPRAY ENVIRONMENTAL COMPLIANCE INSPECTION DATA

TABLE 31: PRE-SPRAY ENVIRONMENTAL COMPLIANCE INSPECTION DATA

(n=169)

Number	Question	Yes (%)	No (%)
1	Is there a storage facility at this location?	27.8	72.2
2	Storage facility located an adequate distance from sensitive receptors (schools, homes, and water bodies/flood plains, etc.)?	56.1	43.9
3	Storage facility fenced?	23.7	76.3
4	Double locks on pesticide storage?	25.8	74.2
5	Leak-free floor and roof?	59.0	41.0
6	Windows barred and screened?	27.9	72.1
7	Adequate lighting?	66.7	33.3
8	Will facility be guarded 24 hours/day?	50.9	49.1
9	Are any pesticides to be used this year in inventory?	40.5	59.5
10	Adequate PPE in inventory for Store keeper and Visitors (Dust mask, coveralls, gloves, boots)?	71.4	28.6
11	Pesticides to be used this year properly labeled?	78.3	21.7
12	Obsolete or expired insecticides?	12.0	88.0
13	Pesticide stacked on pallets with intact packaging?	4.0	96.0
14	Maximum storage height (2 m) exceeded and/or aisles blocked?	34.8	65.2
15	Adequate PPE in inventory for Store keeper and Visitors (Dust mask, coveralls, gloves, boots)?	56.8	43.2
16	Soap, water and tubs available?	60.8	39.2
18	Correct pesticide Health and Safety Sheet laminated and posted?	12.5	87.5
19	Emergency response procedure with phone numbers posted?	5.3	94.7
20	Spill response procedure posted?	19.0	81.0
21	Recording thermometer on wall?	5.3	94.7
22	Fire extinguisher inside and outside storeroom?	10.5	89.5
23	Fully stocked spill kit (Sand bucket, long handle brush with stiff bristle, shovel, and short brush) and first aid kit (Band-Aids, gauze, antibiotic cream, eye wash, hydrocortisone cream/calamine, and aspirin)?	37.5	62.5
24	Containers for contaminated wastes available and	26.3	73.7

Number	Question	Yes (%)	No (%)
	clearly marked (empty sachets, masks, etc.)		
25	Storekeeper trained on signs of poisoning and location of nearest treatment facility	44.6	55.4
26	Antidotes to pesticides available nearby?	74.1	25.9
27	Pregnancy tests administered?	68.6	31.4
28	Is there a soak pit at this location?	80.0	20.0
29	Is the soak pit located away from water bodies, steep slopes or flood prone areas?	89.3	10.7
30	Are soak pit and surroundings cleared of vegetation and cleaned?	89.8	10.2
31	Is the soak pit correctly fenced, gated, locked & strongly built to hang pumps?	75.0	25.0
32	Is there an adequate water supply for personnel and clothes washing and triple rinse of pumps?	77.6	22.4
33	Are the washing areas properly sloped to drain to the soak pit, with no leaks or cracks?	94.3	5.7
34	Does the sawdust, charcoal, and gravel appear to be adequate & well placed and prepared to act as a filter?	84.0	16.0
35	Are there seven progressive rinse barrels and overall wash tubs?	68.6	31.4
36	Are there lines to dry the clothes and are they strong enough to carry the load?	60.5	39.5
38	Are there showers and toilets with adequate privacy and drainage present? (male/female)	74.8	25.2

10.2.2 MORNING MOBILIZATION DATA

TABLE 32: MORNING MOBILIZATION DATA

(n=69)

Number	Question	Yes (%)	No (%)
1	Have the spray operators eaten breakfast and had plenty of water to drink prior to donning PPE?	100.0	0.0
2	Are SOs in full PPE before boarding truck? (Helmet/visor, overalls, boots, gloves, mask, neck protection, flashlight)	80.9	19.1
3	Are any spray operators eating after donning PPE?	4.4	95.6
4	Do operators fill spray pumps using the contents of drums 1, 3, and 5 and 7 from the previous day's progressive rinse?	85.3	14.7
5	Are barrels 1, 3, 5 and 7 empty when Spray Operators depart for the field?	85.5	14.5
6	Do barrels 2, 4, and 6, have sufficient water for the day's cleanup?	84.8	15.2
7	Are the operators properly seated in the transport vehicle with the pump secured between their legs?	74.2	25.8

10.2.3 HOMEOWNER PREPARATION

TABLE 33: HOMEOWNER PREPARATION DATA

(n=73)

Number	Question	Yes (%)	No (%)
1	Did the SO ask if the residents have been informed about the spray activities?	100.0	0.0
2	Have all personal belongings, food items, animals/sick persons been removed from the structure?	100.0	0.0
3	Have all items that cannot be removed been properly covered with plastic sheet?	41.1	58.9
4	Have the residents been instructed not to enter for 2 hours, and then open windows and door to air out for 30 minutes before moving back in?	100.0	0.0
5	Have residents been informed to wash itchy skin, and to go to a health clinic if they don't feel well after their house has been sprayed?	100.0	0.0
6	Are all animals kept outside the structure during spraying and for 2.5 hrs. afterward?	100.0	0.0
7	If there are people (sick, elderly, babies) that cannot be moved, is this household being sprayed?	18.1	81.9
8	Have the residents been told to sweep up dead mosquitoes and deposit them in latrine pit and not to allow children or animal inside until this has been completed?	100.0	0.0
9	Are the residents told not to plaster, paint or clean the sprayed surfaces?	100.0	0.0

10.2.4 SPRAY OPERATION PERFORMANCE

TABLE 34: SPRAY OPERATOR PERFORMANCE DATA

(n=108)

Number	Question	Yes (%)	No (%)
1	Are SOs in full PPE? (Helmet/visor, overalls, boots, gloves, mask, neck protection, flashlight)	74.1	25.9
2	Is mixing of the insecticide witnessed by the household resident?	100.0	0.0
5	Is the tank shaken to mix the contents before pressurizing?	92.0	8.0
6	Is the pump pressurized to 55 psi before spraying?	95.4	4.6
8	Are SOs spraying only the recommended surfaces? (walls, eaves, inside of doors, ceiling)	93.5	6.5
9	Are the SO spraying floors, metal roofs, the outside of doors, glass, inside of cupboards, wallpaper, food granaries, curtains, latrines, animal pens?	8.3	91.7
10	Is the pump re-pressurized if the tank pressure falls below 25 psi?	91.5	8.5
11	Are any of the SOs observed smoking, drinking or eating during the day?	5.6	94.4
12	Have there been any reported accidents or complaints of pesticide exposure from residents or operators?	18.7	81.3

10.2.5 STORE KEEPER PERFORMANCE

TABLE 35: STORE KEEPER PERFORMANCE DATA

(n=25)

Number	Question	Yes (%)	No (%)
1	Do people entering the pesticide storage area wear masks?	100.0	0.0
2	Do people wear masks, gloves, boots and overalls when handling pesticides?	100.0	0.0
3	Do warehouse teams eat inside the warehouse?	16.0	84.0
4	Are there soap and water basins available for washing hands?	76.0	24.0
5	Is the current pesticide Material Safety Data Sheet (MSDS) posted?	8.0	92.0
6	Are storekeepers familiar with the symptoms of pesticide poisoning?	100.0	0.0
7	Is there a fully stocked emergency first aid kit present?	87.5	12.5
8	Do storekeepers know where the nearest health facility is located?	100.0	0.0
9	Are the antidotes for the pesticide in use available at the health facility?	54.2	45.8
10	Are there records of pregnancy testing available?	4.0	96.0
11	Is there a thermometer for monitoring daily temperature in the storage facility?	8.0	92.0
12	Is there a spill kit and a fire extinguisher in the warehouse?	60.0	40.0
13	Is there any evidence of pesticide leakage (theft)?	0.0	100.0
14	Is the pesticide stock stored no more than 2 m high and off of the ground?	40.0	60.0
15	Is the number of sachets or bottles counted and recorded before distribution to SO?	96.0	4.0
16	Is there a system of recording stock cards?	96.0	4.0
17	Are the stock cards up to date?	91.7	8.3
18	Is there an adequate filing system?	92.0	8.0
19	Using these stock cards, can the storekeeper indicate the quantity and age of remaining stock?	100.0	0.0
20	Using these stock cards, can the storekeeper indicate the quantity of stock that has been used to date?	92.0	8.0
21	Are stocks stored on shelves and labeled?	40.0	60.0
22	Are pesticides properly labeled?	80.0	20.0
23	Are the insecticides distributed on a "first expiry, first out (FEFO)" system so that the insecticide that arrived first is distributed first?	92.0	8.0
24	Are there any insecticides past their expiration date?	12.0	88.0

Number	Question	Yes (%)	No (%)
25	Are barrels or containers for empty sachets and used masks available and clearly labeled?	80.0	20.0
26	Are the used sachets counted and stored neatly in the labeled containers?	87.5	12.5
27	Does the number of empty sachets equal what the storekeeper indicates as the quantity of stock issued to date?	88.0	12.0
29	Is there a strategy in place for disposing of solid waste?	92.0	8.0

10.2.6 TRANSPORTATION

TABLE 36: TRANSPORTATION DATA

(n=27)

Number	Question	Yes (%)	No (%)
1	Does the driver and/or vehicle have the needed certification (driver's license, etc.) for transporting hazardous goods or numerous people?	59.1	40.9
2	Has the driver attended safety training?	3.7	96.3
3	Other than the pesticide sachets or bottles for the day's use, are any pesticides transported in the same vehicle with the operators?	3.7	96.3
4	Are food products, animal feed, or consumer goods transported in the same truck as pesticides?	11.1	88.9
5	Is there 1. a spill kit (sand, shovel, bucket), 2. spill/emergency/accident response procedures in the vehicle?	0.0	100.0
6	Is there a first aid kit including eyewash in the vehicle?	100.0	0.0
7	Do drivers have a telephone and appropriate PPE in case of a spill or accident?	88.9	11.1
8	Can the pesticides be adequately secured and tied down in the vehicle?	100.0	0.0
9	Does the spray operator transport vehicle have seats and railings?	53.8	46.2
10	Is the vehicle overcrowded?	0.0	100.0
11	Is there evidence of pesticide leakage in the trucks?	74.1	25.9

10.2.7 END OF DAY ACTIVITIES

TABLE 37: END OF DAY ACTIVITIES DATA

(n=104)

Number	Question	Yes (%)	No (%)
1	Do the SOs continue to wear PPE on the way back to the operations site?	92.2	7.8
2	Upon return to the storehouse, are full and empty sachets returned to stores?	100.0	0.0
3	Are the empty sachets counted and stored in labeled, sealed containers?	95.2	4.8
4	Do the SOs complete their daily report forms?	100.0	0.0
5	Are forms checked by spray supervisors?	97.1	2.9
7	Have any SOs complained of irritation (throat, skin, etc.)?	53.8	46.2
8	Are there wash facilities with soap and water available for operators?	91.3	8.7
9	Do workers at a minimum wash their face and hands with soap and water?	96.1	3.9

Number	Question	Yes (%)	No (%)
10	Is there a sloped concrete catchment area or tarpaulin spread out on the ground to catch all effluent?	87.3	12.7
11	Are all people (spray operators, washers, maintenance techs) in the wash/soak pit area wearing full PPE?	91.2	8.8
12	Is anyone eating or drinking prior to removing PPE and washing?	19.2	80.8
13	Is all pesticide remaining in pumps emptied into the #1 drum?	92.0	8.0
14	Are the #2, 4 and 6 drums filled with water?	83.0	17.0
15	Are spray pumps triple rinsed using the progressive rinse method?1	91.9	8.1
16	Are the outsides of the pumps rinsed off in the soak pit?	94.2	5.8
17	Are the helmets, visors, boots, and gloves rinsed off in the soak pit?	89.4	10.6
18	Are the overalls washed and then hung for drying?	89.3	10.7
19	Is the soak pit used to dispose of all contaminated water?	92.2	7.8
20	Does all contaminated water drain properly into the soak pit?	90.3	9.7
21	Is the soak pit absorbing all the effluent waste without creating a puddle and/or run off?	90.3	9.7
23	Are spray pumps hung upside down to dry?	82.5	17.5
24	Are washed spray pumps stored in an orderly way for easy preparation the next day?	80.2	19.8
25	Are the covers placed on the 7 triple-rinse drums after all pumps are cleaned?	42.0	58.0

10.2.8 POST SPRAY INSPECTION

TABLE 38: POST-SPRAY INSPECTION DATA

(n=105)

Number	Question	Yes (%)	No (%)
1	Is this a temporary store?	79.0	21.0
2	Have all the IRS items, insecticides and wastes been removed from this store?	75.2	24.8
3	Has the store been washed with soap and water?	86.3	13.7
4	Is the soak pit covered and the gates locked?	78.1	21.9
5	Are the soak pit and its surroundings left clean?	70.5	29.5

10.3 EXAMPLE OF IRS CAMPAIGN CHECKLIST USED BY ZIMBABWEAN GOVERNMENT STAFF

**MINISTRY OF HEALTH AND CHILD CARE
NATIONAL MALARIA CONTROL PROGRAMME**

IRS Environmental compliance supervision Checklist No. 4867

Date 11/11/13

Province MANICORLAND District MUPFAS Ward 24 Village ST ANDREWS SEC. STAFF HOUSES

Supervisor MARIE J. Spray Operator Name/Number RAINOS MUTAMBANASHE Household Number NGO BZA SONEY

Spray Operator (SO) issued with PPE & C:

Overalls: Face Mask: Face shield: Aprons:

Rubber boots: Gloves: Helmet:

Check whether Spray Operators did the following;

Item	Yes	No	Comments
Does the spray operator inform occupants about spraying?	<input checked="" type="checkbox"/>	<input type="checkbox"/>	
Does SO ensure that food items, water, cooking utensils are covered and/or taken outside?	<input checked="" type="checkbox"/>	<input type="checkbox"/>	TAKEN OUTSIDE
Does the SO ensure that all items hanging or pasted on the walls are removed?	<input checked="" type="checkbox"/>	<input type="checkbox"/>	
Does the SO ensure that the house occupants are outside during spraying?	<input checked="" type="checkbox"/>	<input type="checkbox"/>	
Does the SO communicate the need for occupants to remain outside for 2-3 hours after spraying?	<input checked="" type="checkbox"/>	<input type="checkbox"/>	
Does the SO ensure domestic animals are outside during spraying?	<input type="checkbox"/>	<input checked="" type="checkbox"/>	NOT THERE
Does the SO use PPE & C consistently?	<input checked="" type="checkbox"/>	<input type="checkbox"/>	
Does the SO agitate the sprayer periodically during spraying?	<input checked="" type="checkbox"/>	<input type="checkbox"/>	
Does the SO hold lance at 45cm from sprayed surface?	<input checked="" type="checkbox"/>	<input type="checkbox"/>	
Does the SO maintain the correct overlap between swaths?	<input checked="" type="checkbox"/>	<input type="checkbox"/>	
Does the SO maintain the right spray speed and consistency?	<input checked="" type="checkbox"/>	<input type="checkbox"/>	
Does the SO check the operational pressure regularly?	<input checked="" type="checkbox"/>	<input type="checkbox"/>	
Does the SO release the pressure trigger when the sprayer is not in use?	<input checked="" type="checkbox"/>	<input type="checkbox"/>	
Does the SO complete spraying of wall?	<input checked="" type="checkbox"/>	<input type="checkbox"/>	
Does the SO complete spraying of roof?	<input type="checkbox"/>	<input checked="" type="checkbox"/>	TOO HIGH
Does the SO spray behind doors?	<input checked="" type="checkbox"/>	<input type="checkbox"/>	
Does spray behind immovable furniture?	<input checked="" type="checkbox"/>	<input type="checkbox"/>	
Does the SO eat and drink during spraying?	<input type="checkbox"/>	<input checked="" type="checkbox"/>	
Does the SO smoke during spraying?	<input type="checkbox"/>	<input checked="" type="checkbox"/>	
Does the SO use mobile phone during spraying?	<input type="checkbox"/>	<input checked="" type="checkbox"/>	
Does the SO avoid environmental pollution?	<input checked="" type="checkbox"/>	<input type="checkbox"/>	
Does the SO properly fill the Spray Operator's Notebook	<input checked="" type="checkbox"/>	<input type="checkbox"/>	

Post Spraying Environmental compliance Activities to be checked

Did the SO handover of empty insecticides sachets to the camp guard?	<input checked="" type="checkbox"/>	<input type="checkbox"/>	
Did the SO clean the sprayers using progressive rinsing approach?	<input checked="" type="checkbox"/>	<input type="checkbox"/>	
Was the cleaning of the sprayers done at the washing slab draining liquid waste in the soakpit?	<input checked="" type="checkbox"/>	<input type="checkbox"/>	
Did the SO change his/her PPC after a day's work?	<input checked="" type="checkbox"/>	<input type="checkbox"/>	
Did the SO take a bath before handling food?	<input checked="" type="checkbox"/>	<input type="checkbox"/>	

No. of rooms targeted by Spray Operator Team 1660 No. of rooms sprayed by Spray Operator 43 No. of sachets used by Spray Operators 11

Additional comments:

10.4 DISTRIBUTION OF PROCURED PPE BY PROVINCE

TABLE 39: DISTRIBUTION OF PROCURED PPE BY PROVINCE

Item	Total Quantity Procured	Quantity Provided to Province							Overstock Items Returned to AIRS Zimbabwe
		Mashonaland Central	Mashonaland East	Manicaland	Mashonaland West	Midlands	Matabeleland North	Masvingo	
Overalls	2400	258	313	874	385	125	127	318	0
Gumboots	1200	127	157	444	185	63	63	158	3
Helmets	1200	132	157	442	190	64	51	158	6
Gloves	2400	248	316	884	380	126	126	316	4
Hand Towels	1200	135	157	436	185	63	63	157	4
Satchels	1200	125	157	450	185	63	63	157	0
Cotton Socks	2400	259	314	888	370	126	126	314	3
Mutton Cloth	1200	127	157	444	187	65	61	159	0
Progressive Rinsing Drums	149	32	10	6	4	29	30	38	0
First Aid Kits	50	9	7	14	5	4	4	7	0
Spill Kits	95	12	13	34	0	5	5	13	13
15 Liter Galvanized Buckets	1200	125	157	450	185	63	63	157	0
Aprons	1200	126	158	450	183	63	63	157	0
Black PVC Sheets	46	5	6	17	7	2	3	6	0
Liquid Soap	1200	132	157	450	178	63	63	157	0
Washing Bar Soap	1200	126	157	450	185	63	62	157	0
Washing Powder Soap	1200	126	157	450	185	63	62	157	0
Face Masks (20 per box)	12,340	1,280	1,620	4,520	1,940	660	660	1,620	40
Face shields	1200	128	158	442	188	63	63	158	0

O-Ring 102 Buna	300	32	39	111	47	16	16	39	0
Adapter for Spray Pump	870	92	114	321	137	46	46	111	3
Male Fitting Valve XP	150	16	20	54	24	8	8	19	1
Nozzle Nut Multi-jet	240	20	27	100	33	13	12	35	0
Connector Hose	585	62	77	195	93	30	31	70	27
Gasket Nozzle	300	32	39	99	47	16	16	34	17
Valve Assay Check	150	16	20	50	24	8	8	24	0
Cover Assay	300	32	39	107	47	16	16	32	11
Extension Sub Assay	90	8	10	30	12	5	5	20	0
Gasket Simplex Cover	390	41	51	132	62	21	21	61	1
100lb Pressure Gauge	450	43	59	163	71	24	24	64	2
Clamp Hose	585	61	77	192	91	30	31	65	38
Chain Cover	150	15	20	52	22	8	8	25	0
Cup Replacement Kit	300	32	39	111	47	16	16	39	0
Flow Regulator	2000	209	263	737	316	105	105	263	2
Gasket Nozzle	2000	209	263	733	317	105	105	53	215
Supply Tube	400	38	53	124	63	19	19	84	0
Nozzle Assembly	660	69	87	208	104	34	34	10	114
Brass Cylinder	75	0	10	23	12	5	5	20	0
Spring for Simplex Lid	150	0	20	54	24	8	8	36	0
Tip Nozzle	1000	0	132	367	158	53	53	32	205
O-Ring 113	240	0	32	88	38	12	12	58	0

10.5 MONITORING AND EVALUATION PLAN INDICATOR MATRIX – 2013 RESULTS

TABLE 40: MONITORING AND EVALUATION PLAN

Performance Indicator ⁶	Indicator Definition	Project Year(s) Reporting	Data Source(s) and Reporting Frequency	Disaggregate	Indicator Type	Annual Targets & Results					
						Year 1		Year 2		Year 3	
						Targets	Results	Targets	Results	Targets	Results

Component I: Establish cost-effective supply chain mechanisms including procurement, distribution and storage of IRS-related commodities and execute all aspects of logistical plans for IRS-related activities.

I.1 Procurement

I.1.2 Number and percentage of international procurement orders for equipment, including PPE, received at port of entry, 30 days prior to start of spray operations.	[Numerator: Number of international procurements for equipment, including PPE, at port of entry, 30 days prior to start of spray operations] [Denominator: Total number of international procurements for equipment, including PPE.] Calculation: $[\text{Numerator} \div \text{Denominator}] \times 100$	Y1, Y2, Y3	<i>Data source:</i> Project records – warehouse inventory books <i>Reporting frequency:</i> Each spray season	By Spray Campaign	AIRS	N.A.; 85%	2; 0%	2; 100%	1; 50%		
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⁶ Not all AIRS project indicators are relevant in Zimbabwe. Thus, we note only those indicators that AIRS Zimbabwe is responsible for measuring, per the approved annual work plan. Please refer to the AIRS Performance Management Plan (PMP) for a full list of the project indicators.

Performance Indicator ⁶	Indicator Definition	Project Year(s) Reporting	Data Source(s) and Reporting Frequency	Disaggregate	Indicator Type	Annual Targets & Results					
						Year 1		Year 2		Year 3	
						Targets	Results	Targets	Results	Targets	Results
1.1.3 Number and percentage of local PPE procurement orders that are delivered to the Abt office in Harare or to government-owned district warehouse(s) 14 days before the start of spray operations	<p>[[<i>Numerator</i>: Number of local PPE procurement orders delivered to the main warehouse 14 days before the start of spray operations]</p> <p>[<i>Denominator</i>: Total number of local PPE procurements.]</p> <p><i>Calculation</i>: [Numerator ÷ Denominator] x 100</p>	Y1, Y2, Y3	<p><i>Data source</i>: Project records</p> <p><i>Reporting frequency</i>: Each spray season</p>	By Spray Campaign	AIRS	N.A.; 80%	13; 0%	11; 100%	13; 76%		

Component 2: Implement safe and high-quality IRS programs and provide operational management support

2.1 Planning and Design of IRS Programs

2.1.1 Annual IRS country-specific work plan developed and submitted on time	Milestone: (Complete/Not Complete)	Y1, Y2, Y3	<p><i>Data source</i>: Project records</p> <p><i>Reporting frequency</i>: Annually</p>		AIRS	Complete	Complete	Complete	Complete		
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Performance Indicator ⁶	Indicator Definition	Project Year(s) Reporting	Data Source(s) and Reporting Frequency	Disaggregate	Indicator Type	Annual Targets & Results					
						Year 1		Year 2		Year 3	
						Targets	Results	Targets	Results	Targets	Results
2.2 Support of Safety and Health Best Practices and Compliance with USAID and Host Country Environmental Regulations											
2.2.1 SEA/letter report submitted on time	Milestone: (Complete/Not Complete)	Y1, Y2, Y3	Data source: Project records – submitted SEAs/ letter reports Reporting frequency: Each spray campaign	By Spray Campaign	AIRS	Complete	Complete	Complete	Complete		
2.2.3 Number of government environmental and health officers trained in IRS environmental compliance	Total number of government environmental and health officers trained in IRS environmental compliance using AIRS Project resources	Y1, Y2, Y3	Data source: Project training reports Reporting frequency: Semi-annually	By Spray Campaign By Gender	AIRS	38	37; 34 males, 3 females	283; 273 males, 10 females	573; 481 males, 92 females		
2.2.4 Number of spray personnel trained in environmental compliance and personal safety standards in IRS implementation	Total number of spray personnel who attended a training in environmental compliance and personal safety standards in IRS implementation using AIRS Project resources. This includes all staff who received environmental compliance training, i.e. spray operators, team leaders, washpersons, storekeepers, etc.	Y1, Y2, Y3	Data source: Project records – Training reports Reporting frequency: Each spray season	By Spray Campaign By Gender	AIRS	802	754; 688 males, 66 females	N.A.	75; 67 males, 8 females		

Performance Indicator ⁶	Indicator Definition	Project Year(s) Reporting	Data Source(s) and Reporting Frequency	Disaggregate	Indicator Type	Annual Targets & Results					
						Year 1		Year 2		Year 3	
						Targets	Results	Targets	Results	Targets	Results
2.2.6 Number of adverse reactions to pesticide exposure documented	Total number of incidents of pesticide exposure reported that resulted in a referral for medical care	Y1, Y2, Y3	Data source: Incident report forms Reporting frequency: Each spray season	By Spray Campaign By residential/occupational exposure	AIRS	0	0	N.A.	N.A. ⁷		
2.2.7 Number of Abt-owned vehicular accidents reported	Total number of accidents in Abt-owned vehicles reported	Y1, Y2, Y3	Data source: Vehicular incident report forms Reporting frequency: Each spray season	By Spray Campaign	AIRS	0	0	0	0		
2.3 Support Entomological Monitoring Activities and Insecticide Resistance Strategies											
2.3.1 Number of sentinel sites supported by the AIRS project	Total number of entomological sentinel sites supported by the AIRS project	Y1, Y2, Y3	Data source: Entomological reports Reporting frequency: Annually	By Spray Campaign	AIRS	4	4	4	4		
2.3.2 Number and percentage of entomological monitoring sentinel sites measuring all five	[<i>Numerator</i> : Number of entomological monitoring sites measuring all five primary PMI entomological indicators]	Y1, Y2, Y3	Data source: Entomological reports <i>Reporting</i>	By Spray Campaign	AIRS	3	0; 0%	4; 100%	4; 100%		

⁷ In 2013, AIRS Zimbabwe did not procure insecticide or support spray operator (Level 3) training.

Performance Indicator ⁶	Indicator Definition	Project Year(s) Reporting	Data Source(s) and Reporting Frequency	Disaggregate	Indicator Type	Annual Targets & Results					
						Year 1		Year 2		Year 3	
						Targets	Results	Targets	Results	Targets	Results
primary PMI entomological indicators	<i>[Denominator: Number of entomological monitoring sentinel sites]</i> <i>Calculation: [Numerator ÷ Denominator] × 100</i>		<i>frequency: Annually</i>								
2.3.3 Number and percentage of entomological monitoring sites measuring at least one secondary PMI indicator	<i>[Numerator: Number of entomological monitoring sites measuring at least one secondary PMI indicator]</i> <i>[Denominator: Number of entomological monitoring sites]</i> <i>Calculation: [Numerator ÷ Denominator] × 100</i>	Y1, Y2, Y3	Data source: Entomological reports Reporting frequency: Annually	By Spray Campaign	AIRS	4; 100%	3; 75%	4; 100%	4; 100%		
2.3.4 Number and percentage of insecticide resistance testing sites that tested at least one insecticide from each of the four classes of insecticides recommended for malaria vector control	<i>[Numerator: Number of insecticide resistance testing sites that tested at least one insecticide from each of the four classes of insecticides recommended for malaria vector control.]</i> <i>[Denominator: Number of insecticide resistance testing sites]</i> <i>Calculation: [Numerator ÷ Denominator] × 100</i>	Y1, Y2, Y3	Data source: Entomological reports Reporting frequency: Annually	Spray Campaign By Type of Insecticide	AIRS	N.A.	0	12; 100%	4; 33.3%		
2.3.5 Number of wall bioassays conducted within 2 weeks of spraying to evaluate the quality of IRS	Total number of wall bioassay studies conducted in established sentinel sites to evaluate quality of IRS spraying activities	Y1, Y2, Y3	Data source: Entomological reports Reporting frequency:	By Spray Campaign	PMI	3	1	30	29		

Performance Indicator ⁶	Indicator Definition	Project Year(s) Reporting	Data Source(s) and Reporting Frequency	Disaggregate	Indicator Type	Annual Targets & Results					
						Year 1		Year 2		Year 3	
						Targets	Results	Targets	Results	Targets	Results
			Per spray campaign								
2.3.6 Number of wall bioassays conducted after the completion of spraying at monthly intervals to evaluate insecticide decay	Total number of wall bioassay studies conducted at monthly intervals in established sentinel sites to evaluate the rate of insecticide decay on sprayed surfaces	Y1, Y2, Y3	Data source: Entomological reports Reporting frequency: Per spray campaign	By Spray Campaign	PMI	3	0	150	100 ⁸ ; 66.7%		
2.3.7 Number of vector susceptibility tests for different insecticides conducted in selected sentinel sites	Total number of vector susceptibility tests conducted to gauge the effectiveness of individual insecticides proposed for use in spray operations	Y1, Y2, Y3	Data source: Entomological reports Reporting frequency: Per spray campaign	By Spray Campaign By Type of Insecticide	PMI	N.A.	N.A.	48	15 ⁹		
2.4 Conduct Communications Activities and Community Mobilization											
2.4.2 Number of IRS print materials disseminated	Total number of IRS educational materials developed, printed and distributed to community members in target spray districts using AIRS Project resources	Y1, Y2, Y3	Data source: Project records Reporting frequency: Semi-annually	By Spray Campaign By Type of printed material and message(AIRS	N.A.	N.A.	50,000	36,950		

⁸ Tests in Kawere and Kasimure may be continued in April 2014.

⁹ Additional tests are pending for the week of 10-14 March 2014.

Performance Indicator ⁶	Indicator Definition	Project Year(s) Reporting	Data Source(s) and Reporting Frequency	Disaggregate	Indicator Type	Annual Targets & Results					
						Year 1		Year 2		Year 3	
						Targets	Results	Targets	Results	Targets	Results

Component 3: Provide ongoing monitoring and evaluation and quality control measures

3.1 Submit Monitoring and Evaluation Plan (MEP) to PMI-Zimbabwe	Submit an updated MEP to PMI-Zimbabwe after each spray season <i>Milestone: (Complete/Not Complete)</i>	Y1, Y2, Y3	Data source: Project records Reporting frequency: Semi-annual		AIRS	Complete	Complete	Complete	Complete		
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Component 4: Contribute to Global IRS Policy-Setting and Country-Level Policy Development of Evidence-Based IRS; Disseminate Experiences and Best Practices

4.1 Number of guidelines/checklists/ tools related to IRS operations developed or refined with project support	Total number of implementation guidelines, process checklists and program tools related to IRS operations developed or refined using the technical and/or financial resources of the AIRS Project	Y1, Y2, Y3	Data source: Project records – Activity reports Reporting frequency: Semi-annually	By Guideline/ checklist/tool	AIRS	N.A.	2 By tool: EC monitoring checklist; room-to-structure conversion DCT	4	2 By tool: Revised EC monitoring checklist; soak pit construction guidelines		
4.3 Number of best practice presentations given at national/ regional/international workshops and conferences	Total number of project-related oral and poster presentations delivered in national, regional and/or international meetings related to IRS.	Y1, Y2, Y3	Data source: Project records – Activity reports Reporting frequency: Semi-annually	By IRS Technical Area	AIRS	N.A.	1; Tech area: environmental compliance	3	27 Tech area: IRS implementation, entomology		

Component 5 (Cross-cutting): Capacity Building, Knowledge Transfer, Gender Inclusion

Performance Indicator ⁶	Indicator Definition	Project Year(s) Reporting	Data Source(s) and Reporting Frequency	Disaggregate	Indicator Type	Annual Targets & Results					
						Year 1		Year 2		Year 3	
						Targets	Results	Targets	Results	Targets	Results
5.1 Capacity Building (Gender Inclusion)											
5.1.4 Number of government environmental and/or health officials trained in IRS oversight	Total number of national and sub-national/district government environmental and/or health officials who are trained in oversight of IRS implementation using AIRS Project resources	Y1, Y2, Y3	Data source: Project records – Training reports Reporting frequency: Semi-annually	By Spray Campaign By Gender Percentage of Women Trained Type of government official (e.g. enviro/health)	AIRS	38	37; 34 males, 3 females	283; 273 males, 10 females	573; 481 males, 92 females		
5.1.5 Conduct a capacity assessment	AIRS Zimbabwe program conducted an assessment of IRS capacity among national and sub-national/district government health officials	Y1, Y2	Data source: Project records – Capacity assessment reports Reporting frequency: Semi-annually		AIRS	Complete	In process	Complete	Complete		
5.1.6 Number of capacity-building MOUs signed by AIRS, NMCP and partners/ institutions	Total number of Memoranda of Understanding (MOU) on provision of local capacity building finalized and signed between AIRS, the National Malaria Control Program, and other local partners and institutions	Y1, Y2, Y3	Data source: Project records – MOUs Reporting frequency: Semi-annually	By Spray Campaign	AIRS	N.A.					