Indoor Residual Sprays for Malaria & Dengue Prevention During Military Operations A Pocket Guide

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Jacksonville, FL
2012

DISCLAIMER

Any mention of specific proprietary products, trade names, or manufacturers does not constitute a recommendation or an official endorsement of these products by the Department of Defense but is intended for illustration and information purposes only. Neither should the absence of an item necessarily be interpreted as DoD disapproval. Information or inquiries concerning any equipment or items should be forwarded to your Command Pest Management Professional or Applied Biologist.

FOREWORD/ACKNOWLEDGEMENTS

This pocket guide (PG) was written to consolidate information and procedures to conduct indoor residual spraying (IRS), reducing the threat of malaria and dengue fever during military operations.

This PG outlines safe and effective IRS practices and also provides a list of recommended equipment and insecticides for performing IRS applications. This is not a regulation, but provides guidance to those individuals responsible for conducting pest control during military deployments.

This guide will receive periodic review and will be updated to ensure that information presented reflects current technology and policy.

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1. INTRODUCTION

Indoor Residual Spray (IRS) is an insecticide application technique used to protect personnel against nuisance pests and human disease carrying insects (mosquitoes, sand flies, kissing bugs). This technique targets insects that prefer to rest or feed indoors which make contact with the treated surfaces (walls), obtaining a lethal dose of insecticide.

IRS has been used extensively in malaria and dengue virus prevention and control programs throughout the world. To be effective, however, it is extremely important to know what mosquitoes are present in your area as IRS applications work against mosquitoes (vectors) known to rest (endophilic) or feed (endophagic) indoors.

Malaria Vectors that Rest and/or Feed Indoors

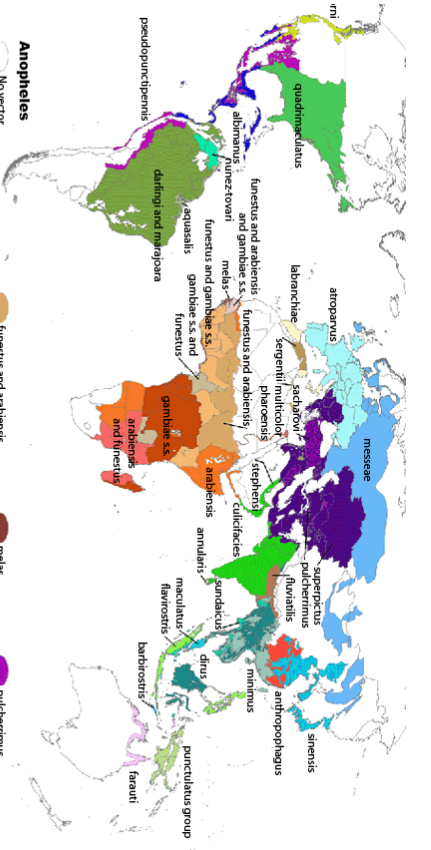
Below is a list of malaria vectors known to rest or feed indoors. The map below is a guide that illustrates global distribution of important malaria vectors.

***Anopheles* (spp.)**

annularis	*nunez-tovari*
culicifacies	*pseudopunctipennis*
fluviatilis	*pulicherrimus*
gambiae	*sacharvori*
labranchiae	*sergenti*
darlingi	*stephensi*
melas	*subpictus*
minimus	*superpictus*
nili	*sundaicus*

Global distribution of the dominant malaria vectors

From Kiszewksi et al., 2004 American Journal of Tropical Medicine and Hygiene 70(5): 486-498.

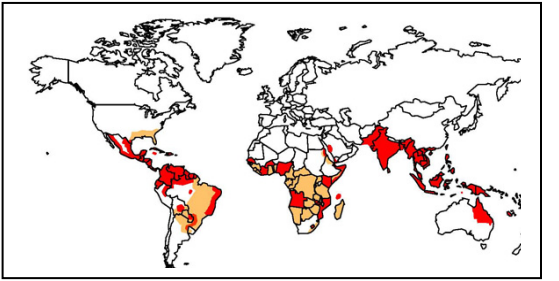


Dengue Vectors that Rest or Feed Indoors:

Aedes aegypti accounts for > 95% of all dengue virus cases worldwide. It is a small black and white mosquito with a lyre-shaped marking on the back of the thorax. This mosquito species is a daytime biter that readily bites people indoors, resting on wall surfaces after taking a blood meal. It also vectors chikungunya and yellow fever viruses.

Aedes aegypti
(Photo by CDC)

"Lyre" Shape (Alabama Vector Management Society)



CDC map showing distribution of *Aedes aegypti* in yellow and dengue outbreaks in red (for year 2000).

Additional Resources for Operational Planning

A great resource for determining the risk of vector-borne disease in a particular geographic location is the National Center for Medical Intelligence. Country specific Infectious Disease Risk Assessments can be found on the National Center for Medical Intelligence Website at https://www.intelink.gov/ncmi/index.php.

A resource for determining what mosquito species are present in a particular area is the Walter Reed Biosytematics Unit Mosquito Catalog, which can be found at the following website: http://www.mosquitocatalog.org/ and the MosquitoMap found at: http://www.mosquitomap.org/. On-site vector surveillance should also be conducted to validate this information as well as to continually assess entomological risks.

2. SAFETY

Safety is everyone's responsibility. To ensure insecticide applications are conducted safely, follow all safety requirements listed on the product label.

DoD personnel who apply insecticides must be certified Category 8 (Public Health Pest Control) in accordance with DoDI 4150.7-P and DoDI 4150.7-M or if not certified, must under the direct or on-site supervision of certified personnel.

Prior to insecticide application read the entire product label to include the precautionary statement and Material Data Safety Sheet (MSDS) to ensure that you have the proper personal protective equipment (PPE).

Always use and wear PPE properly. Insecticide applicators should be respirator fit-tested prior to spraying.

Eating, drinking and smoking while applying insecticides is prohibited.

Wash your hands and face thoroughly after applying insecticides and before participating in any other activity.

HEAT INJURY PREVENTION

IRS applications can be physically demanding, particularly in harsh environments. Applicators operating in hot, humid areas are especially at risk for heat-related injuries.

To Reduce Heat Injuries Applicators should:

-Take frequent breaks

-Hydrate frequently to prevent dehydration

-Before drinking any liquids remove gloves and wash hands with soap and water

-Wear light clothing

-If possible, spray during the cooler parts of the day (early morning/evening)

3. PERSONAL PROTECTIVE EQUIPMENT

All personnel involved in IRS operations must be adequately protected against insecticide exposure. Personal protective equipment should be worn in accordance with requirements listed on the insecticide label.

Common PPE includes:

- Half Face Respirator
- Face shield or non vented goggles
- Long-sleeved overalls
- Nitrile gloves

SAFETY EQUIPMENT

The following National Stock System (NSN) listed equipment is listed in the AFPMB's TG 24: Contingency Pest Management Guide.

As equipment information is frequently updated, current listings may be accessed at: http://www.afpmb.org/content/dod-standard-pesticides-and-pest-control-equipment.

DESCRIPTION	NSN
AURAL PROTECTOR, SOUND	4240-00-759-3290
BOOTS, hip, black rubber (size 10)	8430-00-241-2780
BOOTS, hip, black rubber (size 11)	8430-00-241-2781
BOOTS, hip, black rubber (size 12)	8430-00-241-2782
BOOTS, hip, black rubber (size 9)	8430-00-262-8256
BOOTS, knee, rubber, 15 in. high (size 10)	8430-00-262-8257
BOOTS, knee, rubber, 15 in. high (size 11)	8430-00-262-8258
BOOTS, knee, rubber, 15 in. high (size 12)	8430-00-262-8259
COVERALLS, olive drab (SM)	8405-00-131-6507
COVERALLS, olive drab (MED)	8405-00-131-6508
COVERALLS, olive drab (LG)	8405-00-131-6509
COVERALLS,, olive drab (XLG)	8405-00-131-6510
GLOVES, Nitrile (size 9)	8415-01-012-9294
GLOVES, Nitrile (size 10)	8415-01-013-7382
GOGGLES, industrial, non-vented. .	4240-00-190-6432

RESPIRATORS AND ACCESSORIES

Description	NSN
3M Respirators	
half-face, 3M 7500 series (SM)	4240-01-495-1294
half-face, 3M 7500 series (MED)	4240-01-495-1293
half-face, 3M 7500 series (LG)	4240-01-495-1291
full-face, 3M 7800 series (SM)	4240-01-314-2780
full-face, 3M 7800 series (SM/MED)	4240-01-342-5239
full-face, 3M 7800 series (MED/LG)	4240-01-301-3200
CARTRIDGE, 3M P/N 6001 fits 7500 & 7800 respirator	4240-01-246-5407
701 Cartridge filter adaptor for use with 6001 OV Cartridge	4240-01-389-7449
North Respirators	
Half Face, 550030 series, P/N: 5501P95L-12 (LG)	4240-01-249-9261
Half Face, 550030 series, P/N: 5501N95M-12 (MED)	4240-01-249-9262
Half Face, 550030 series, P/N: 5501N95S-12	4240-01-249-9263
Organic Vapor Cartridge & P100 Particulate Filter P/N: 7581P100	4240-01-249-2573
P100 Particulate Filter P/N: 7580P100	4240-01-249-2572

Use Recommendations

Clean and maintain PPE as recommended.

Wear clean PPE daily.

Protect respirators from dust, sunlight, extreme temperatures, moisture, and chemicals when stored.

A positive/negative pressure test should be performed on respirators before and after each use.

When gas powered sprayers are used, hearing protection is required. Additionally, ensure doors and windows are open to allow fresh air to circulate throughout the building.

4. INSECTICIDE APPLICATION EQUIPMENT

Two types of stock system listed equipment can be used to apply IRS: 1) hand compressed sprayers and 2) backpack sprayers. The table below lists hand compressed and backpack sprayers available through the stock system. Your choice will depend on many factors including the area to be covered, availablility of fuel, weight and cube.

Nomenclature	NSN
Sprayer, Pesticide, Manually Carried, 1-gallon stainless tank, with pressure gauge.	3740-00-191-3677
Sprayer, Pesticide, Manually Carried, 2-gallon stainless tank with pressure gauge.	3740-00-641-4719
Sprayer-Duster, Pesticide, Backpack, STIHL® Model SR450, gasoline engine driven. Tank size –3.5 gal.,	3740-01-463-0147
Sprayer, Pesticide, Manually Carried Hydraulic Backpack sprayer	3740-01-496-9306
Sprayer, Pesticide, Manually Carried Hydraulic Backpack sprayer. Birchmeier, Model Iris	3740-01-543-0676
Sprayer, Pesticide, Manually Carried Compressed Air Backpack sprayer. Dorendorf P/N AQSZ-12	3740-01-561-9663

Hudson X-PERT® Hand Compressed Sprayer

STIHL® Model SR450

Dorendorf JQSX Sprayer

Birchmeier Iris Sprayer

5. EQUIPMENT CALIBRATION

All spray equipment must be properly calibrated. Failure to do so can result in improper application and control failure.

***DO NOT USE INSECTICIDES WHILE CALIBRATING EQUIPMENT.**

CALIBRATING HAND COMPRESSED AND NON-MOTORIZED BACKPACK SPRAYERS

To determine output in gallons per minute (GPM) use a graduated cylinder to collect water over a period of 30 seconds. The following formula will allow you to calculate the GPM:

[fl oz in 30 seconds] x 2 ÷ 128 = GPM

[ml in 30 seconds] x 2 ÷ 3785 = GPM

TO MAXIMIMIZE EFFICIENCY SELECT THE FLAT FAN NOZZLE

STIHL BACK PACK CALIBRATION

The flow rate for the STIHL® SR420 and SR450 backpack sprayers can be adjusted by turning the metering knob. The tables below display discharge rates for the SR420 and SR450 as provided in the owner's manual. However calibration should be performed prior to each use, validating the information provided below:

Knob Position	SR 420 GPM	SR450 GPM
1	0.03	0.18
2	0.12	0.38
3	0.23	0.50
4	0.34	0.59
5	0.42	0.70
6	0.48	N/A

Add 1/8 gallon [16 fl oz, 473 ml] water to the tank. Record the time that its takes to discharge all of the water. Use the following formula to determine the machine output in gallons per minute (GPM):

[60 ÷ (time to spray 1/8 gallon)] X 0.125. = GPM

6. AREA PREPARATION

It is critical to prepare the area being sprayed. Failure to prepare may result in ineffective insecticide application.

-Food and cookware should be removed (i.e. food, water, food utensils)

-All electrical equipment, (computer, TV, stereo equipment) should be covered with a cloth or tarp

-Move all furniture to the center of the room and cover, ensuring that all walls are accessible

-All items should be removed from walls, to allow the applicator full access. (i.e., pictures, maps, and posters)

-Advise occupants to vacate the area until the re-entry time specified on the insecticide label has elapsed

-Inspect all wall surfaces to ensure the insecticide treatment will adhere to the wall.

7. SPRAY OPERATIONS

Equipment and pesticides for IRSs are available through the National Stock System (NSN). Information may be found at: www.afpmb.org

After choosing the product, calculate the surface area to be covered. This will allow you to determine the amount of product and water necessary to complete the job.

NOMENCLATURE	NSN
Insecticide, Lambda-cyhalothrin (Surrender Pest-tab) **pyrethroid insecticide**	6840-01-431-3357
Insecticide, Lambda-cyhalothrin, 9.7% (Demand CS) **pyrethroid insecticide**	6840-01-428-6646
Insect Repellent, clothing application, 40% permethrin, liquid (2-Gal sprayer) **pyrethroid insecticide **FOR USE ON TENTS ONLY**	6840-01-334-2666
**** PERMETHRIN SOLUTIONS ARE INEFFECTIVE ON VINYL-COATED TEMPER TENTS****	

Application Technique

Practicing a proper technique while spraying will help the applicator efficiently achieve complete coverage of the area. The following technique was adopted from the President's Malaria Initiative Best Management Practices (BMP) Manual, BMP for Indoor Residual Spraying (IRS) in Vector Control Interventions. Walls should be sprayed in vertical swaths using downward and upward motions. To ensure the insecticide coverage is continuous, swaths should overlap by 2 in.

Proper form will allow the applicator to maintain a consistent swath width. The spray tip should be kept approximately 18 in (45 cm) from the wall throughout the spray stroke. To maintain this distance, the applicator should lean forward to start spraying at the top of the wall, leaning backward as the nozzle is brought down the wall, and vice versa when using an upward stroke. This procedure should be continued while working completely around the room.


18 in.

8. POST SPRAY OPERATIONS

Following insecticide application, the applicator must take several precautions to ensure the safety of individuals re-entering the facility. The insecticide label will list the Re-entry Time (RT), which is the period of time following the application until occupants may re-enter the area. Do not allow occupants to re-enter until the RT has passed. When no RT is listed on the label, ensure all treated surfaces are completely dry before allowing people back into the facility.

Residents should be advised to sweep any dead insects that may be present and dispose of them in a plastic bag.

After spray operations, applicators should immediately shower to remove any insecticides they may have contacted during the application.

Be sure to perform necessary post-treatment maintenance to ensure the equipment is in good repair to include all hoses, nozzles and the tank. Clothing and protective equipment should be placed in a designated area away from people,

pets, and the normal laundry. After each day, launder clothing, including clothes worn under protective coveralls. Ensure clothing used during treatments is washed separately from any other clothing not involved in the IRS operations.

9. GUIDANCE

Contingency Pest Management Guide AFPMB Technical Guide 24

Guide to Pest Surveillance During Contingency Operations. AFPMB Technical Guide 43

USAID President's Malaria Initiative BMP Manual

USAF Guide to Operational Surveillance of Medically Important Vectors and Pests

10. POINTS OF CONTACT

Contingency Liaison Officer
Armed Forces Pest Management Board
Email: afpmb-webmaster@osd.mil
COM: 301-295-7476

U.S. Navy Entomology Center of Excellence
Email: NECE-FleetSupport@med.navy.mil
COM: 904-542-2424
DSN: 942-2424

U.S. Army Public Health Command
PHCR-North Entomological Sciences Division
Email: PHCR-NorthESD@amedd.army.mil
COM: 301-677-3466
DSN: (312) 622-3466

U.S. Navy and Marine Corps Public Health Center
COM: 757-953-0700
DSN: 377-0700
Website: www.nmcphc.med.navy.mil

APPENDIX A

ACRONYMS

AFPMB	**Armed Forces Pest Management Board**
AOR	**Area of Responsibility**
BMP	**Best Management Practices**
CDC	**Centers for Disease Control and Prevention**
DoD	**Department of Defense**
GPM	**Gallons per minute**
IRS	**Indoor Residual Spray**
NECE	**Navy Entomology Center of Excellence**
NMCPHC	**Navy and Marine Corps Public Health Center**
NSN	**National stock number**
PPE	**Personal protective equipment**
RT	**Re-entry Time**
TG	**Technical guide**