



Pacific Mosquito Surveillance Strengthening for Impact



## **RESIDUAL SPRAYING AGAINST *AEDES* VECTORS IN THE PACIFIC**

### **SPRAY OPERATOR FIELD GUIDE**

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## Residual Spraying



*Aedes* mosquitoes can transmit viruses to humans such as dengue, chikungunya and Zika.



Residual spraying involves applying long-lasting insecticides to surfaces on which vectors commonly rest.

### Two main features of residual spraying:

- targets vectors **where they rest**
- insecticide remains active for **at least 3 to 4 months** after spraying

### Where, when, how and what to spray is based on:

- *Aedes* species present
- their resting locations
- their susceptibility to insecticides available for residual spraying

## Types of Residual Spraying

There are three main types of residual spraying against *Aedes*:

<b>Indoor residual spraying</b>	Use where key vector(s) mainly rest indoors, e.g., <ul style="list-style-type: none"><li>• <i>Ae. aegypti</i></li></ul>
<b>Outdoor residual spraying</b>	Use where key vector(s) mainly rest in or inhabit exterior harbourage sites around houses and public spaces e.g., <ul style="list-style-type: none"><li>• <i>Ae. aegypti</i></li><li>• <i>Ae. albopictus</i></li><li>• <i>Ae. polynesiensis</i></li></ul> Includes: <ul style="list-style-type: none"><li>• external structures and surfaces</li><li>• outdoor furniture</li><li>• foliage and vegetation</li><li>• larval habitats</li></ul>

**Use the appropriate mix**  
of indoor and outdoor spraying  
for the key vector(s) present.

## Targets of Residual Spraying

Residual spraying against *Aedes* should be targeted to:



**Response areas:** locations with *Aedes*-borne disease outbreak or elevated risk



**Housing units:** houses and associated structures that are common resting sites of *Aedes* vectors



**Community spaces:** structures and common areas where *Aedes* vectors rest and people sleep or gather during the day e.g., markets, schools, community centres



**Sprayable surfaces:** all areas within and around structures where *Aedes* vectors rest that can retain residual insecticide



**Harbourages:** outdoor areas that are potential *Aedes* vectors resting sites and larval habitats

The aim is to treat **sprayable surfaces** of all appropriate **structures** for every **housing unit** and **community space** plus all **harbourages** within a **response area**.

## Personal Protective Equipment

Always wear the full set of clean PPE before beginning to mix or spray insecticides. Pesticide labels list minimum requirements.

### This may include:

**Ear protection** if using motorised mist-blower

**Helmet + face shield**  
(or goggles + hat)

**Full or half-face respirator**  
(with organic filter cartridge)  
that seals tightly around nose  
and mouth

**Neck protection to cover**  
between the face shield and  
shoulders

**Gloves** worn outside overalls

**Overalls** worn over  
**rubber boots**

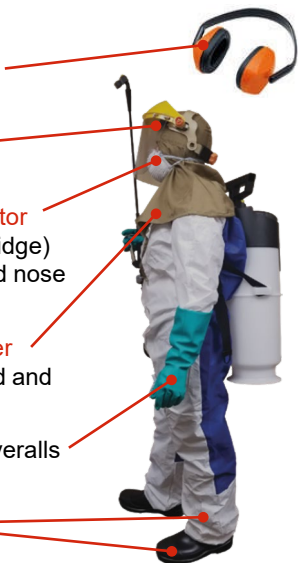


Image source: Abt Associates/USAID

Inform Team Leader immediately if any PPE items do not fit comfortably or are damaged (e.g., torn)

## Health and Safety

Generally, all insecticides are poisonous and can be harmful if improperly used.

### When handling insecticides:



- Read insecticide labels before use.
- Wear full PPE.
- **Do not eat, drink or smoke.**
- De-pressurise and shut off the sprayer when it is not in use or during travel.

### Spray operators must also remember to:



- Drink plenty of water before reporting for work.
- Wash hands with soap and water both before and after eating or drinking.
- Hydrate frequently throughout the day during breaks from spraying.

## First Aid

Immediate action must be taken if any of the following occurs:

Inhale liquid droplets (spray)	<ul style="list-style-type: none"><li>• Exit the house immediately.</li><li>• Sit down in the fresh air under shade.</li><li>• Inform Team Leader.</li></ul>
Skin contact	<ul style="list-style-type: none"><li>• Take off all contaminated clothing immediately.</li><li>• Wash exposed skin immediately with soap and plenty of water.</li><li>• Inform Team Leader if skin irritation persists after washing.</li></ul>
Eye contact	<ul style="list-style-type: none"><li>• Rinse immediately, thoroughly, and several times with water, being sure to rinse under the eyelids.</li><li>• Inform Team Leader.</li></ul>

Stop working and inform your Team Leader immediately if you experience any of the following in the course of the day:

- Breathing difficulties
- Headache
- Fatigue
- Eye irritation
- Skin irritation
- Any other form of ill-health or discomfort



# Daily Spray Tasks

## 1. Before leaving for the spray site:

### SPRAY OPERATORS (SO)

- check PPE for condition
- prepare sprayer and check for any issues (e.g., leaks, not holding pressure)
- report any issues to **TL**

### TEAM LEADER (TL)

- brief **SOs** on day's plan
- give each **SO** insecticides and reporting forms

- travel to spray site (with sprayers depressurised and secured upright)

## 2. At the spray site:

### SPRAY OPERATORS

- engage with community members
- spray housing unit (and yard) or community space
- review post-spray instructions with householder
- fill in property spray cards and daily spraying record
- report any issues to **TL**

### TEAM LEADER

- engage with community leaders
- allocate each **SO** houses
- Observe **SO** procedure and provide corrective action

- travel back to wash point once complete for the day

### 3. After returning to wash point:

#### SPRAY OPERATORS

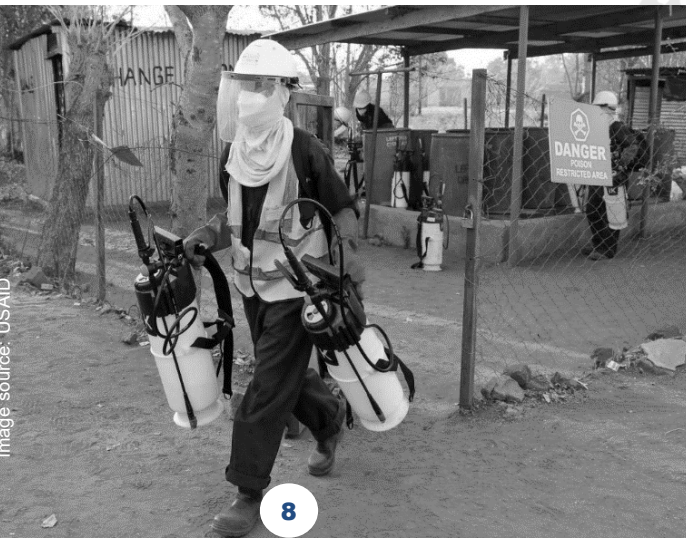
- dispose of remaining insecticide as per label
- clean equipment using progressive rinse process
- remove, clean and store PPE
- clean self with soap and water
- provide all forms to **TL**

#### TEAM LEADER

- confirm clean up
- collect forms from each **SO**
- review insecticide use for each **SO**

- attend de-brief of day's activities and raise any key issues, challenges or other important information

Image source: USAID



## Preparing Housing Units

Spray Operators should confirm that the following preparations are complete:

- ✓ Informed consent has been given to spray
- ✓ Clean water (approx. 15 litres) is available for the team to use for mixing insecticide
- ✓ These have been covered or removed:
  - water
  - food
  - water containers
  - food containers
  - cooking utensils
  - children's toys
  - bedding
  - clothing
- ✓ All objects of value have been put away e.g., mobile phones, money, documents.
- ✓ All occupants and animals are away from the structures to be sprayed.

**Ask:** Does anyone who is currently home have any breathing difficulties such as asthma?



→ stress the importance of staying away from the area being sprayed

Are there birds, fish or reptiles present?



→ remove from area, cover cage/tank or turn off aqua filters for 30 minutes

## Spraying Order and Priorities

**Rapid response** is essential during outbreaks.

**Priorities** are defined to improve efficiency. These must be based on known resting sites of local *Aedes* vectors in local structures. For instance:

- Indoors: dark surfaces close to the floor, lower parts of walls/curtains, under furniture, bedrooms
- Outdoors: under outdoor furniture, shaded areas like vegetation, sheds, storage areas, machinery/equipment, water containers

### **At each housing unit or community space:**

1. Start with the main structure
2. Then spray structures close to the main structure
3. Then inspect and spray potential outdoor harbourages (adult resting sites and larval habitats) including furniture, other objects and vegetation

### **Inside each structure:**

- If multiple floors, start with the upper and move towards the lower floors
- Move clockwise through the structure, starting from the main (front) entrance
- Target mosquito resting areas, such as bedrooms, bathrooms, storage and living rooms

### Within each room:

- Start at the doorframe and spray exposed wall surfaces and curtains first, moving clockwise around the room
- Spray dark areas under and behind large furniture
- Spray under smaller furniture and other surfaces

### In each yard:

- Conduct yard inspection and spraying concurrently
- Start at the gate/yard entrance moving clockwise around the yard
- Look up, look down and look around to identify natural and artificial containers that can hold water or harbour mosquitoes
- Treatment depends on the container type



## Do Not Spray

- ✗ People or animals
- ✗ Housing units, yards or community spaces:
  - where permission to spray has not been granted
  - that pose a risk to spray operators (e.g., dangerous animals present, like vicious dogs)
- ✗ Kitchens
- ✗ Rooms with:
  - an inhabitant who cannot be moved
  - birds or reptiles that cannot be moved
- ✗ Containers or utensils used for food storage or preparation
- ✗ Children's toys
- ✗ Clothing or bedding
- ✗ Running or storm water
- ✗ Water tanks, ponds or waterways with fish
- ✗ Animal food or water bowls

**Stop spraying** if anyone enters the house or if people or animals come within 10 metres (m) while you are spraying outside areas or yards.

## Hand Compression Sprayer

A variety of hand-operated pneumatic sprayers are suitable for residual spraying. The Goizper iK Vector Control Super sprayer is often used in the Pacific.

### Components include:

**Lance** to deliver insecticide to surfaces

**Safety valve** to protect against over-pressurising

**Lid with spare nozzle and filter storage**

**Tank** translucent to see insecticide volume

**Straps** adjustable for use on 1 or both shoulders

**Footrest** integrated for securing sprayer

**Filler filter** carried inside tank

**Control Flow Value (CFV)** for constant pressure in nozzle and auto cut-off

**Parking lance and hose** for easy carrying

**Fan nozzle and filter** for 580 ml/min with CFV

**Nozzle protector** to prevent clogs or damage

Images source: Goizper Group

Flexible lance and/or angled nozzle tip (120° elbow for spraying under furniture



## Mixing Insecticide and Pressurising Sprayer



Wear appropriate PPE. Follow the pesticide product label. The recommended volume of water for Goizper Vector Control iK Super sprayer is 7.5 litres.

Mix the insecticides by:

- Adding directly to water in spray tank if:
  - packed in water soluble sachet
  - packed in unit dose
- Pre-mixing with water then adding to spray tank if:
  - packed in bulk soluble form

Pressurise the sprayer by closing the lid and pumping the handle as directed. Continue until the safety valve begins releasing pressure (for Goizper sprayer).

**Listen for air leaks** as the sprayer is pressurised. Check to see the lance is not dripping liquid. Notify the team leader if you notice pressure escaping from tank.

- De-pressurise the sprayer while not in operation.



## Examples of mixing for different products



### For liquid formulations

(e.g., Actellic 50EC)

1. Introduce 4-5 litres of water into spray tank (through a filter or cloth).
2. Pour correct amount of solution for final tank volume amount (75 ml if 7.5 litres).
3. Fill with water up to the 7.5 litre mark (through a filter or cloth).
4. Close lid and pump sprayer until:
  - safety valve begins releasing pressure and green mark shows (Goizper iK VC Super sprayer) or
  - 55 psi is reached (if no CFV).
5. Shake the filled sprayer to mix the contents before spraying.

### For liquid formulations

(e.g., Actellic 300CS)

1. Introduce 3 litres of water into spray tank (through a filter or cloth).
2. Remove sieve, shake insecticide bottle, open and empty all contents into tank.
3. Rinse empty insecticide bottle with 0.5 litres of water and empty into spray tank (through a filter or cloth). Repeat 2 more times for a total of 3 rinses.
4. Close the lid of sprayer and pump sprayer with 5 full strokes.
5. Pick up sprayer with both hands. Hold it by tank body and vigorously shake side to side, 10 times.
6. De-pressurise the sprayer.
7. Open lid and add water up to 7.5 litre mark (through a filter or cloth).
8. Close lid and pump sprayer until:
  - safety valve releases pressure and green mark shows (Goziper iK VC Super sprayer) or
  - 55psi is reached (if no CFV)

**For powders and granules**  
(e.g., SumiShield 50WG)

1. Place the sprayer on a plastic sheet.
2. Introduce 3 litres of water into spray tank (through a filter or cloth).
3. Remove sieve, open insecticide packet and empty all contents into tank.
4. Close the lid of sprayer and pump sprayer with 5 full strokes.
5. Pick up sprayer with both hands. Hold it by tank body and vigorously shake side to side, 10 times.
6. Place the sprayer back on the plastic sheet and de-pressurise the sprayer.
7. Open lid and add water up to 7.5 litre mark (through a filter or cloth).
8. Close lid and pump sprayer until:
  - safety valve releases pressure and green mark shows (Goizper iK VC Super sprayer) or
  - 55psi is reached (if no CFV)

## Re-pressurising the sprayer



The tank must remain sufficiently pressurised during spraying. Re-pressurise when the flow of pesticide shuts off automatically (if there is a CFV) or when the pressure is 25 psi or lower.

**Sprayer  
with 1.5 bar CFV**

**Spray**  
without checking  
pressure gauge

**Stop spraying**  
when insecticide flow  
automatically shuts off  
as pressure is below  
minimum required

**Repressurise**  
by placing sprayer on  
ground and pumping  
until safety valve  
releases pressure and  
green mark shows

**Sprayer  
without CFV**

**Spray**  
while periodically  
checking pressure  
gauge to ensure  
pressure is above 25 psi

**Stop spraying**  
when pressure is  
25 psi or lower

**Repressurise**  
by placing sprayer on  
ground and pumping  
to 55 psi

## Checking sprayer discharge rate



Calibrate sprayers regularly (at least monthly during heavy use) to ensure correct discharge rate and to detect any problems.

### While wearing PPE:

- Pour water into tank to maximum 3/4 full
- Cap and pressurise above minimum required to spray e.g., 4 bar (58 psi)
- Check tank is holding pressure (listen for hiss)
- Check no leaks along lance and hose especially at any joins
- Confirm on/off valve works
- Spray for 1 minute, collecting discharge and measure in jug
- Repeat three times and calculate the average ml released per minute

For a Goizper iK VC Super sprayer (with 1.5 bar CFV), the correct discharge for 80° flat fan nozzle (8002) should be **580 ml per minute** ± 10%, which is **520-640 ml per minute**.

- If higher by >10% then nozzle tip probably worn (= need to replace)
- If a) no spray, b) discharge rate is incorrect or low, or c) spray deposition pattern is inconsistent then probably clogged (= need to clean)

## Indoor Residual Spraying



- Insecticides must be applied as stated on the **product label**
- Ensure all directions for use are observed
- Aim is consistent coverage at 580 ml per minute to give 33 ml per square metre on the sprayed surface
- Spray technique should be adapted based on what is being sprayed e.g.,
  - walls
  - curtains
  - large furniture
  - light furniture

When operating the sprayer, **pay attention** to the following and report any issues to your Team Leader:

- leaks
- blockages
- worn nozzles (signified by irregular and uneven flow patterns)

## Spraying exposed interior walls



- stand about 1 metre (m) from surface to be sprayed
- leave about 45 centimetres (cm) between surface and spray nozzle (for swath width of 75 cm)
- start spraying at 1.5 m high and move spray down, step to the right to get to the middle of the next swath, then spray from the bottom up to 1.5 m
- try to keep an even distance between the surface and nozzle - you will need to squat as you come down low
- ensure a 5 cm overlap between spray swaths
- maintain a smooth comfortable action (leaning forwards or backwards as needed):
  - arm fully extended when spraying high or low on a vertical surface
  - arm bent 90° at elbow towards waist when lance is horizontal
- use a uniform spraying speed of about 3.5 seconds for a 1.5 m long (75 cm wide) swath

## Spraying exposed interior walls

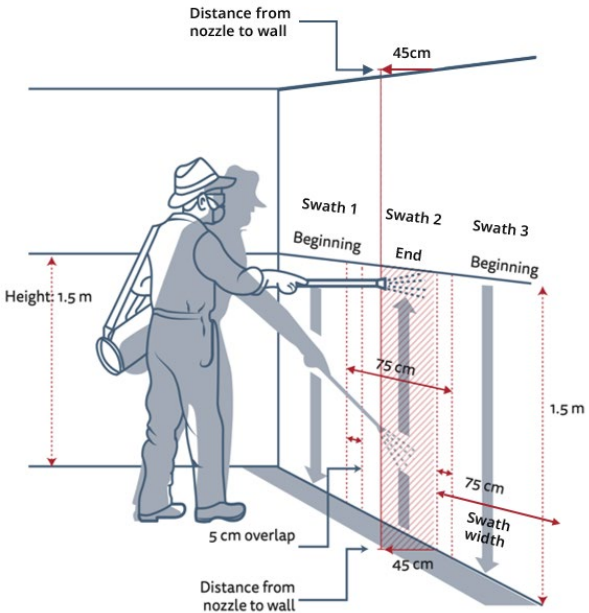


Image source: PAHO



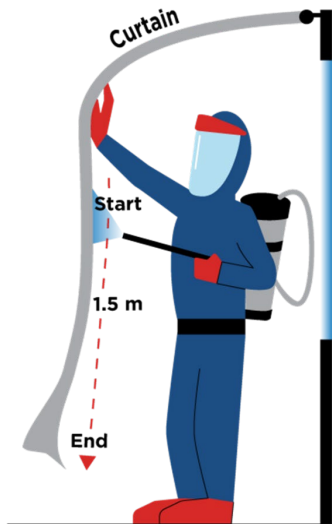
## Spraying curtains

It may be sufficient to spray only the outer surface of curtains:

- carefully flick the curtain sideways and spray the lower wall behind the curtain
- close the curtain and spray the lower outer surface of the curtain
- take care to avoid damage as curtain fittings may be delicate

If there is evidence of *Aedes* often resting on the interior side:

- step between the wall and curtain
- extend the curtains away from the wall with your hand
- spray from the upper side to the lower side of the curtain at 2.5 seconds per m
- pay attention to folds to ensure a uniform spray pattern

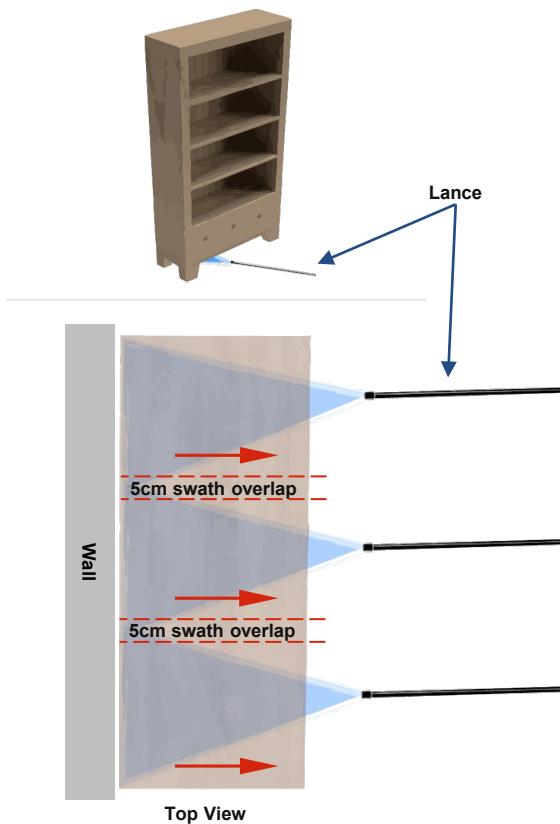


## **Spraying under or behind large furniture**

For wardrobes or cupboards, it is important to spray under and behind them:

- introduce the lance below the wardrobe to reach the side farthest from the spray operator
- orient the inclined nozzle towards the wardrobe to ensure that spraying jet is on the target surface
- to the extent possible, keep the nozzle about 30 cm away from the wardrobe surface
- spray at twice the speed required for wall surfaces i.e., 1 second per m (make sure you spray before run-off occurs)
- apply swathes progressively to ensure the entire target surface is covered, noting that the swathes will be narrower
- stop spraying when the nozzle reaches the edge of the wardrobe.

## Spraying under or behind large furniture

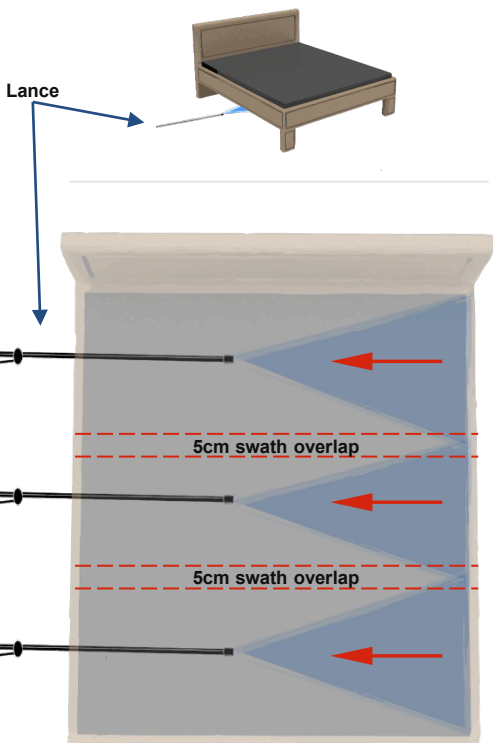


## **Spraying under beds**

Bend at the knees and crouch lower to treat under the bed:

- introduce the lance below the bed to reach the farthest side of the bed (e.g., near the wall)
- orient the inclined nozzle towards the bed so the spraying jet will wet the bed target surface
- start spraying, at a rate of around 1 second per metre
- stop spraying when the nozzle reaches the external edge of the bed near you
- introduce the lance below the bed at about 30-45 cm away from the last position and start spraying again from the farthest side
- repeat as many times as necessary to cover the entire bed target surface

## Spraying under beds



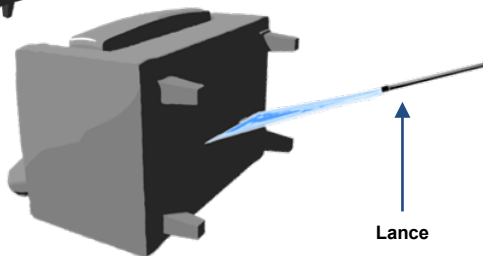
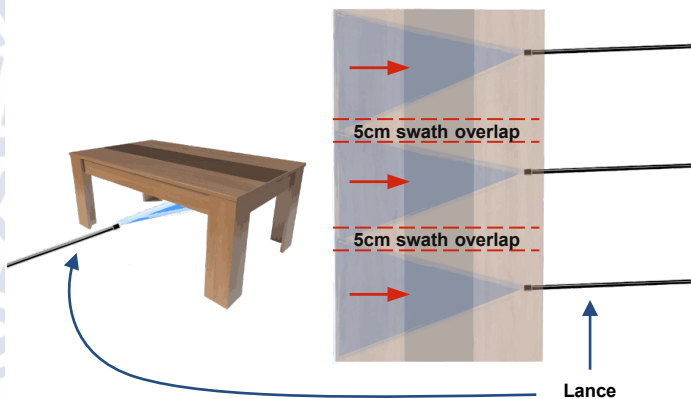
Top View

## **Spraying tables and light furniture**

Light furniture should be sprayed after completing larger furniture:

- identify furniture to be sprayed. These can include chairs, sofas, tables, cabinets, desks, and those that have areas where a mosquito can hide.
- start spraying from the one side to the other side of the target surface
- adapt the distance of spraying from the nozzle to the object, depending on the width of the object
- with the nozzle 45 cm away from the surface, spray with a speed that covers 1 m in 2.5 seconds
- if the distance from the nozzle to the target surface is shorter than 45 cm, increase the spraying speed to 1 second per m
- ensure that the target surface is covered uniformly.

## Spraying tables and light furniture



## Motorised Backpack Mist-blower

STIHL SR-450 mist-blowers can be used for rapid insecticide coverage of large areas, such as community spaces or outdoor sites.

### Spray unit components include:





## Motorised Backpack Mist-blower

STIHL SR-450 mist-blowers can be used for rapid insecticide coverage of large areas, such as community spaces or outdoor sites.

**Arm components include:**



## Preparing the blower



### Pre-start checks

- Check fuel system for damage or leaks e.g., fuel cap/ tank, hose connections and primer bulb
- Check spark plug boot is secure
- Check all levers move freely and trigger springs back to idle position
- Check chemical tank & hoses for damage or leaks

### Fuelling up

- Before fuelling, clean the filler cap and the area around it to ensure that no dirt falls into the tank
- Position the machine so that the filler cap faces up
- Turn the cap counter-clockwise until it can be removed from the tank opening
- Fill with unleaded petrol and 2-stroke oil mixed at 50:1 (see table on page 33)
- Turn the cap clockwise and tighten it down as firmly as possible by hand

## Petrol to oil mix

Petrol (litres)	2-stroke oil (ml)
1	20
5	100
10	200

## Filling the container

- Make sure chemical release switch on handle is closed (downward position)
- Open container cap and check seal for damage or dirt (a poorly sealed container can result in chemical spilling onto user)
- Add water to container and test machine if it has not been used recently
- Fill container with chemical mix do not fill past the 14-litre mark
- Replace cap making sure it has a good seal

## Operating the blower



### Starting

- Close chemical release switch lever
- Close the metering lever
- The setting lever must be on I
- Press the manual fuel pump bulb at least five times (even if bulb is filled with fuel)
- Press in the choke knob and turn it to bottom position if engine has not already been running (if the engine has recently been running and you are restarting the choke knob can be turned to the middle position)

### Cranking

- Place the unit securely on the ground and make sure that bystanders are well clear of the nozzle outlet
- Make sure you have a firm footing. Hold the unit with your left hand on the housing and put one foot against the base plate to prevent it slipping.
- Pull the starter grip slowly with your right hand until you feel it engage and then give it a brisk strong pull. Do not pull out the starter rope to full length (or it might break).

- Do not let the starter grip snap back
- Guide it slowly back into the housing so that the starter rope can rewind properly
- Continue cranking until the engine runs.
- **As soon as the engine runs pull the throttle trigger – the choke knob automatically returns to the run position**
- To stop the engine move the valve lever to the 0 position the engine will stop and lever will spring back to I position

### **Start blowing**

- Use the chemical flow knob on the front to control flow rate.
  - Position 1 = minimum flow rate
  - Position 6 = maximum flow rate (selected position facing forward)
- Move chemical release switch to upward position to start flow and back down to stop
- Pull throttle trigger to spray area: more throttle = smaller droplets and more power
- Remember to stop flow by closing the chemical release valve when not spraying as chemical will continue to flow

## Other hints on starting the blower

If the engine stalls with choke in cold start position or under acceleration:

- Move the choke knob to warm start position and continue cranking until the engine runs



If the engine does not start in warm start position:

- Move the choke knob to cold start position and continue cranking until the engine runs



If the engine does not start:

- Check that all settings are correct
- Check that there is fuel in the tank – refuel if necessary
- Check that the spark plug boot is properly connected
- Repeat the starting procedure

If the fuel tank ran until completely dry:

- After refuelling, press the manual fuel pump bulb at least five times – even if the bulb is filled with fuel
- Set the choke knob according to engine temperature
- Now start the engine

## Cleaning the blower



- Drain the fuel tank following proper disposal processes
- Run the engine until it runs out of fuel
- Thoroughly clean the blower in a well-ventilated area
- Clean the air filter (located behind the plastic cover on the left of the machine - remove 2 screws to access)
- Do not expose the blower container to direct sunlight for unnecessarily long periods of time as UV rays can make the container material brittle, which could result in leaks or breakage

It is important to **clean the blower** if storing for 3 months or longer.



## Outdoor Residual Spraying

A wide range of outdoor sites can be adult resting sites or larval habitats (harbourages) for *Aedes* in the Pacific. These include:

- heavy vegetation or foliage i.e., leafy shrubs, bushes and trees
- under outdoor furniture (benches, tables, chairs)
- sheds or storage areas
- old or disused tyres
- piles of debris or disused equipment
- palm fronds

### Considerations:

- **Time** to complete yard inspection and treatment (including spraying) varies by yard size, layout and quantity of treatment required – but is generally about 15 minutes.
- **Spray coverage** is ideally 100% of potential *Aedes* harbourages in the yard – with all reasonable efforts made to spray these areas.
- **Drying time** of residual spray depends on weather and objects being sprayed - but is generally less than 1 hour.



## Outdoor harbourages

1. Ask and receive permission to inspect and spray around the yard
2. Check yard for any hazards (tripping, animals, people, no-spray objects)
3. Begin inspection and treatment, starting at the gate/ yard entrance and moving clockwise around the yard
  - **Look down:** wells, rainwater down pipes, storm water pits, drain sumps, disused septic tanks, filter/skimmer box of untreated swimming pools
  - **Look around:** artificial and natural containers like tree holes, bamboo, travelling palms, tree, palm stumps
  - **Look up:** roof gutters (especially where trees overhang them), underside of verandahs, underneath elevated houses
4. Treat containers based on their type (see next page), except as indicated on page 12:
  - **Spray:** apply residual spray
  - **Empty or drain:** tip out or remove water
  - **Move:** place under cover out of rain
  - **Invert:** turn over so it cannot hold water
  - **Cover/screen:** add barrier to mosquito entry
  - **Larvicide:** treat water to kill aquatic stages

## Treatment of outdoor harbourages by type

More than one treatment can be used per habitat type

Aedes outdoor habitat type	Treatment type	
	Residual spray	Other
Outdoor furniture	Yes	
Foliage	Yes	
Palm frond	Yes	larvicide
Bromeliad	Yes	fill with sand
Tree hole	No	larvicide
Lawn mower catcher	Yes	empty, move, turn over
Wheelbarrow	Yes	empty, move, turn over
Ice cream container	Yes	empty, move, turn over
Garbage bin	Yes	empty, move
Bucket	Yes	empty, move, turn over
Container small	Yes	empty, move, turn over
Container large	Yes	empty, move, turn over, larvicide
Buckets	Yes	empty, move, turn over, larvicide
Other plastic container	Yes	empty, move
Black plastic/tarp	Yes	empty, move
Pot plant bases	Yes	remove, fill with sand

Self-watering pots	Yes	larvicide, fill outlet with sponge
Tyres	Yes	move, cover with tarp, larvicide
Shells	Yes	empty, move
Pots	Yes	empty, move
Drain sump or pit	Yes	larvicide
Drum	Yes	empty, move, larvicide
Post	Yes	larvicide
Boat	Yes	empty, move, larvicide
Car bodies	Yes	larvicide
Water feature	Yes	larvicide
Roof gutter	No	unblock, larvicide
Disused septic tank	No	larvicide, add screen
Rainwater tank	No	larvicide, add screen
Pool	No	larvicide
Spa	No	larvicide
Pond	No	larvicide
Well	No	larvicide, add screen
Bird bath	No	tip out, upend, larvicide
Animal water bowl	No	empty, clean, refill
Kitchenware or utensils	No	empty, move
Esky / chill box	No	empty, move, turn over

## Harbourages beyond the house and yard

Other locations beyond private residences may be preferred *Aedes* mosquito harbourages:

- Fringing vegetation bordering residential properties or community areas
- Community buildings where people commonly spend time during the day, such as markets, school buildings, churches or hospitals

Instructions for outdoor residual spraying:

- Spray leafy vegetation below 2 m in height, including the underside of leaves where possible
- Spray foliage and leaf litter reaching about 3-5 m beyond the forest fringe
- Spray foliage almost to the point of run-off, avoiding any run-off

Environmental considerations for residual spraying:

- Consider wind direction and risk of spray drift
- Do not spray if vegetation is wet or rain is expected within 1-2 hours
- Avoid run-off into waterways

For residual spray treatment of **large areas**, other spray equipment may be needed for efficiency such as large motorised residual spray units.

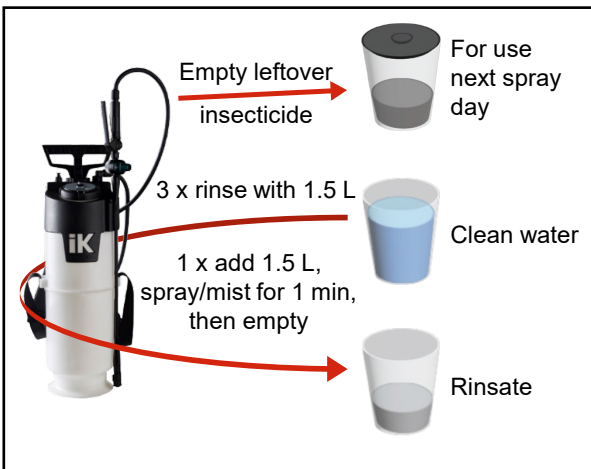
## End of Day Clean Up

Clean equipment while in **full PPE**.

### Simple triple rinse procedure (see also pg.42)

- Empty leftover insecticide into a sealable container and keep for use the next spray day.
- Add 1.5 litre clean water to the used compression sprayer or mist-blower. Shake it and drain the wash liquid (rinsate) into a bucket.
- Repeat the rinse and drain process twice more, adding rinsate to the bucket.
- Add a final 1.5 litre clean water and shake it. Pressurise to 2 bars (for compression sprayer). Spray or blow for 1 minute to discharge water into the bucket to clean the assembly.
- Depressurise (for compression sprayer). Drain the remaining water into the bucket.
- For sprayer: Wipe out tank and wash outside. Disassemble strainer and nozzles and rinse with clean water.
- For blower: Hose system with clean water. Remove strainer from under container cap and rinse with clean water.
- Ensure sprayers and mist-blowers are dry and clean before storing.

## Overview of simple triple rinse procedure:



**All leftover rinse water** must be properly disposed of at end of spray operations in accordance with local requirements (such as in a soak pit or evaporation tank).

## After cleaning sprayers and mist-blowers:

- Wash gloves and boots using clean water.
- Remove in this order: face and head protection, boots, gloves, neck protection, overalls, socks. Return to be washed or stored.
- Take a full-body shower or bath using soap in the designated bathing area.

## Supervision and Data Management

Spray operators are also responsible for collecting information during spraying, including:

- Property spray cards (for households)
- Daily spraying records (for spray team leader)

It is important that the following are accurately recorded each day:

- Number of housing units sprayed
- House structures or yards sprayed, not sprayed or partially sprayed (and reasons for refusal)
- Amount of insecticide used
- Other critical information to inform future spraying operations

Data forms must be completed during the day and provided to the spray team leader at the end of each day.



## **Instructions to Community Members**

### **Instructions to provide in advance**

- each housing unit is to make available at least 15 litres of clean water for teams to mix insecticides in the sprayer and for any other use
- for the day of spraying, you will need to:
  - cover or remove items such as water, foodstuffs and other consumables, cooking utensils, bedding and clothing, children's toys
  - put away all items of value

### **Instructions on the day of spraying**

- do not be present where pesticides are being mixed (particularly children and pregnant and breast-feeding women)
- allow spray teams to enter your houses and associated structures
- remain outside your house or at least 10 metres away during spraying
- similarly relocate pets and domestic animals, caged or leashed, away from the house
- notify the spray team if there are any rooms or houses that cannot be sprayed, such as if there are sick residents that cannot be moved out of the house
- do not prepare food in close proximity to the house during spraying



## Instructions given after spraying

- all occupants and animals must remain outside until the sprayed walls and other surfaces have dried, which usually takes about 1 hour
- sweep floors free of residual pesticide and insects killed from the spraying, and dispose of the swept material immediately in a latrine pit or by burying
- open doors and windows after spraying for ventilation for at least 30 minutes as residual odour will dissipate as the insecticide dries and the room gets ventilated
- only after sprayed surfaces have dried, dead insects have been swept up and the house has been ventilated should residents (particularly children, pregnant women or animals) be allowed to enter
- if skin irritation is experienced, wash with soap and water. For eye irritation, flush eyes with water. For respiratory irritation, leave the home for fresh air. If ingested, contact program staff or go to nearest health facility.
- continue using other preventative measures, such as ITNs, to protect against vector-borne diseases

**Information provided** must be as simple as possible and use of technical words should be minimised.

**Post-spray advice forms or information leaflets** can be given to occupants. If no occupant is home, a “call back” card can be left in a prominent place.

# Challenges and Troubleshooting

## Spray equipment

Common issues	Potential solution/mitigation
Control valve does not shut off	<ul style="list-style-type: none"><li>• Clean O-ring and seating surface on control valve.</li><li>• Replace O-ring if worn.</li></ul>
Leaks where wand joins control valve	<ul style="list-style-type: none"><li>• Clean O-ring in lance and sealing surfaces.</li><li>• Replace O-ring if worn.</li></ul>
Tank does not pressurise when handle pumped	<ul style="list-style-type: none"><li>• Lubricate plunger cup with petroleum jelly (not oil).</li><li>• Replace plunger cup.</li></ul>
Leaks where cap joins wand	<ul style="list-style-type: none"><li>• Clean O-ring on wand and sealing surfaces.</li><li>• Replace O-ring if worn.</li></ul>
Leaks where pump seals at tank	<ul style="list-style-type: none"><li>• Clean gasket sealing surfaces or replace gasket.</li></ul>
Air leaks at hose connection	<ul style="list-style-type: none"><li>• Ensure gasket is tight.</li><li>• If O-rings are used, clean sealing surfaces or replace O-rings; re-attach hose.</li><li>• Do not use plastic as a replacement for O-rings or gaskets on the trigger handle as this will affect its structural integrity and may damage it.</li></ul>
Liquid or air enters pump cylinder	<ul style="list-style-type: none"><li>• Clean check valve sealing surface or replace check valve.</li></ul>

## Community engagement and access

Common issues	Potential solution/mitigation
Animal presents danger to spray team e.g., vicious dog	<ul style="list-style-type: none"><li>• Request householder to remove or restrain animal</li><li>• Otherwise, do not enter property</li></ul>
Householders present danger to spray team	<ul style="list-style-type: none"><li>• Do not enter property</li></ul>
Householders enter house during spraying	<ul style="list-style-type: none"><li>• Spraying stops until occupants are instructed to leave the house and comply</li></ul>
Pets are not correctly removed or secured away from the house	<ul style="list-style-type: none"><li>• Request householder to adhere to instructions. Do not proceed with spraying until this is rectified</li></ul>
Environment hazards endanger spray team	<ul style="list-style-type: none"><li>• If identified during initial check, request householder to remove the hazard</li><li>• Otherwise, do not proceed with spraying</li></ul>
Housing endangers spray team e.g., electrical wires, unsafe structure	<ul style="list-style-type: none"><li>• Do not proceed with spraying until this is rectified</li></ul>
Household items are damaged during spray process	<ul style="list-style-type: none"><li>• Inform householder</li><li>• Inform team leader</li></ul>

## Code of Conduct

Courteous and professional conduct is important to maintain good rapport with communities and enable spray activities.

The following are general rules to be followed by spray operators:

**Rule 1:** Always wear uniform properly and maintain it in clean, good working order.

**Rule 2:** Always wear correct personal protective equipment while spraying.

**Rule 3:** Always be courteous towards residents and respectful of their property.

**Rule 4:** If you damage any property, immediately inform your Team Leader and the resident.

**Rule 4:** Give clear instructions to residents so they can adequately prepare for spraying and protect themselves, their family members, domestic animals and pets from exposure to the insecticide applied.

**Rule 5:** Never ask residents to provide food or money for spray operators or activities.

**Rule 6:** Comply with all directives given by team leaders, supervisors and program managers.

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