



Government of **Western Australia**
Department of **Health**

Adult mosquito trapping: EVS/CO₂ trap standard operating procedure



Adult mosquito trapping using EVS/CO₂ traps

The EVS/CO₂ (Encephalitis Virus Surveillance/carbon dioxide) trap (Figure 1), is the most commonly used adult mosquito trap in Western Australia (WA). It uses both CO₂, in the form of dry ice, and light as mosquito attractants. If dry ice is not available, it is possible to use CO₂ from a gas cylinder, but this will require a regulator to be fitted to the trap set-up.

The EVS/CO₂ trap consists of:

1. **Dry ice tin:** an insulated tin that holds the dry ice with holes in the bottom for the CO₂ to escape, and a chain attached to the top to allow for the trap to be hung from a tree (or similar);
2. **Verandah** (optional): attaches to the dry ice tin to protect against adverse weather conditions;
3. **Battery operated motor unit:** with a light to attract mosquitoes and a fan that draws mosquitoes into the catch bag and prevents escape; and
4. **Catch bag:** a plastic container and lid that is attached to the motor unit with a stocking net.



Figure 1: EVS/CO₂ trap

Selecting suitable trap sites

EVS/CO₂ traps are designed to hang from sturdy, semi-horizontal surfaces such as a tree branch, clothes hoist or similar (Figure 2).

To improve the success of your catch and ensure mosquitoes remain in good condition for identification, trap sites should be:

- set amongst trees/foilage where mosquitoes harbour;
- protected from rainfall, high winds and direct sunlight, usually by setting trap on western side of a hanging point, as this helps prevent mosquito death and desiccation;
- sheltered from sprinklers that may cause water damage to mosquitoes;
- free of large numbers of ants or other insects that may access the catch bag and eat the mosquitoes;
- accessible by foot, but not in plain view of the public who may tamper with the trap; and
- set below head height (if not, it can be difficult to remove the trap and may also influence the collection of mosquito species).



Figure 2: Typical trap setting

Occupational health and safety

Dry ice can cause skin burns if not handled correctly. It is preferable to wear appropriate gloves when handling dry ice and avoid contact with skin.

Before setting the trap

Before setting your trap, you will need to:

- Order an appropriate quantity of dry ice, 1 – 1.5kg of pellets per trap (or ensure sufficient gas in CO₂ cylinder);
- Ensure holes at the bottom of trap tin are clear and unobstructed to allow CO₂ to escape;
- Ensure motors are in good working order;
- Check you have sufficient batteries to run motors;
- Ensure you have thick rubber bands (size 86 preferable) around motor housing; and
- Check that the catch bag/lid netting are clean, with no holes.

Batteries

Disposable or rechargeable D-sized batteries are required to run an EVS/CO₂ trap. You will need to consider your trapping routine and requirements when deciding which will be more appropriate to use.

Disposable batteries:

Each time disposable batteries are removed from a motor following overnight trapping they must be marked on the base with a black permanent marker (Figure 3).

A single line across the battery indicates it has been used once and should be stored with the 'once used' batteries.

Two lines marked as an X across the battery indicates it has been used twice and should be discarded.

A motor should have at least one new battery and one 'once used' battery to ensure it will operate for a full night of trapping. Two new batteries should be used if the trap will be left out for approximately 18 hours or more. A twice used battery should never be used as it is likely to result in a trap motor failure.

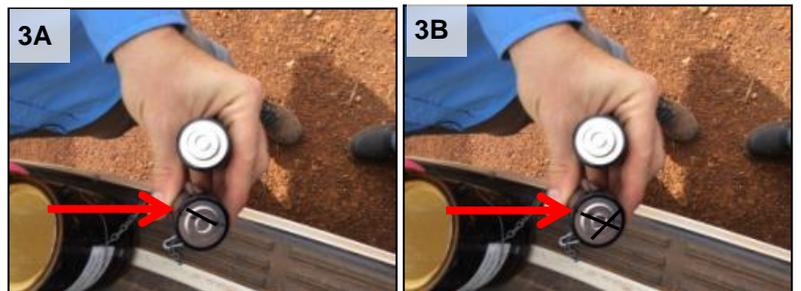


Figure 3: Mark on the battery depending on the usage **3A:** Once used battery **3B:** twice used battery

Rechargeable batteries:

Rechargeable batteries (Figure 4) provide a more environmentally friendly and cheaper way to run EVS/CO₂ traps. Whilst the initial outlay is more expensive, it is cost effective in the long term and there is no regular requirement for battery disposal and replacement. Manufacturer's instructions should be followed when charging batteries, to maintain their capacity and longevity. This process may differ between brands. For example, the rechargeable batteries used by the Department of Health need to be charged for three 16-hour cycles, which takes place over three working days.



Figure 4: Rechargeable batteries in charger

Setting up your EVS/CO₂ trap

To optimise your catch, it is preferable to set the trap before sunset and collect after sunrise as this is the period that most mosquito species are active. The following flow chart provides step-wise instructions on how to set an EVS/CO₂ trap:



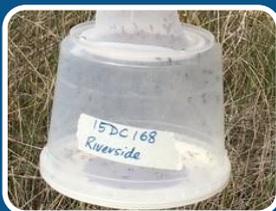
1. Prepare the dry ice tin

- Remove the lid using a paint tin lid opener or screwdriver
- Fill with dry ice (each tin holds approx. 1kg dry ice pellets)
- Fasten lid tightly, using a rubber mallet if necessary
- Ensure there is a chain and clip attached to the tin handle for hanging trap
- Check holes at the bottom of the tin are clear and unobstructed.



2. Attach the Verandah (optional)

- Secure verandah to the base of dry ice tin
- This can be achieved by securely holding onto the tin and turning the verandah until the 'teeth' of tin and verandah engage
- Note: Verandahs are optional, but are recommended in WA to protect against adverse weather conditions.



3. Prepare the catch bag

- Ensure catch bag is clean and netting has no holes in it
- Attach a clean plastic lid firmly to base of trap container
- Use masking tape to label container appropriately (e.g. site location, date).



4. Insert batteries into motor

- Insert one battery into motor unit and turn on
- With motor still on, insert the second battery. If both battery holders are working, a slight increase in fan power can be noticed
- Check motor operation - ensure fan is running smoothly and light is on. Lubricate if necessary. See troubleshooting if not working as expected.



5. Attach catch bag to motor

- Attach catch bag netting to underside of motor unit
- Tie catch bag string in a bow to firmly attach
- Slide rubber band over top of netting and bow to ensure catch bag will not come off
- Attach motor/catch bag to underside of dry ice tin and place trap in desired location.



6. Turn motor on and perform four-point check

- Ensure CO₂ is coming out of the holes at base of dry ice tin
- Ensure light is working and fan is blowing down into catch bag
- Ensure catch bucket is appropriately labelled
- Ensure lid is on catch bucket securely.

Collecting your EVS/CO₂ trap

The flow chart below provides step-wise instructions on how to collect an EVS/CO₂ trap:



1. Remove catch bag

- Check trap motor is still working
- Do **NOT** turn motor off until catch bag is removed, as mosquitoes will escape
- Gently tap sides of netting to cause mosquitoes to drop down into catch bag
- Quickly pinch netting with one hand to prevent mosquitoes re-entering (Note: don't twist netting vigorously as this causes undue wear and tear)
- Use other hand to untie string
- Slide elastic band up onto motor body and remove catch bag
- Wind string around netting where your hand is, to ensure mosquitoes cannot escape (Note: Don't tie string tightly as this can cause damage to netting).



2. Turn motor off and remove trap

- Turn motor off
- Unhook motor body from the underside of dry ice tin
- Unwind chain from hanging point
- Remove dry ice tin/verandah from hanging point



3. Remove batteries

- Remove batteries from motor unit
- If using disposable batteries, mark appropriately (see 'Batteries' above)
- Rechargeable batteries will need to be charged on return to the office.



4. Remove verandah and empty dry ice tin

- Untwist verandah in opposite direction until 'teeth' disengage from dry ice tin
- Open dry ice tin using lid opener
- Place any remaining dry ice into dry ice esky



5. Store motor

- Place motor, with batteries removed, into empty dry ice tin for storage
- Replace lid onto tin
- Note: Motor storage in dry ice tin provides a safe way to transport motors



6. Knock down mosquitoes and store catch bag

- Place catch bag with mosquitoes into dry ice esky to knock them down (kill them)
- Alternatively, mosquitoes can be transported back to office/laboratory in catch bags, where they are knocked down in a freezer.
- Knock down time is variable: 2-3 minutes (dry ice) vs 10 minutes (-20°C freezer)



7. Mosquito storage

- Open catch bag lid carefully (Note, lids are brittle when cold/frozen and can crack easily)
- Transfer mosquitoes into smaller, labelled specimen jars for storage
- TIP: Mosquitoes are transferred to specimen jars easiest by first tipping them from the catch bag onto a piece of folded paper or plastic sheet, before funnelling them into jar
- Remove label from catch bag, wipe out condensation and remove mosquito debris

Trap maintenance:

Motors:

Trap motors should be checked regularly. If the motor is noisy, turn the motor off and lightly apply silicone spray to both ends of the spindle through the middle of the motor and connecting the fan. Turn the motor on again and let it run for a few seconds to move the lubricant into the motor. If after lubricating, the fan is still excessively noisy, spins slowly or not at all, the motor should be replaced and sent for repair. Noisy, slow motors; or motors which fail to immediately start spinning often fail over-night, resulting in a wasted trapping effort.

Light bulb:

Check that the light bulb is lit while the fan is operating. If not, the bulb must be replaced.

Fan:

Broken fans can be replaced with spares, but other broken parts are generally too delicate and should be sent away for repairs.

Catch bags:

Check catch bags for tears and holes in the netting of the sleeve fabric and plastic container lid. These can sometimes be repaired DIY, otherwise they need to be replaced or sent away to be repaired.

Troubleshooting

When setting an EVS/CO₂ trap, the following issues may be encountered:

Issue	Troubleshooting options
Light and fan both not working	<ul style="list-style-type: none">• Check batteries first• If batteries are fine, likely to be a connection issue.• Unit needs repair
Light is on, fan not working or slow	<ul style="list-style-type: none">• Likely to be motor issue• Unit needs repair/replacing• If fan is slow, don't use as it is likely to fail
Light is on, fan is noisy	<ul style="list-style-type: none">• Apply silicon spray (see Maintenance)
Fan is working, light bulb not on	<ul style="list-style-type: none">• Replace light bulb
Fan missing or broken/split	<ul style="list-style-type: none">• Replace fan
CO ₂ gas not coming out of tin	<ul style="list-style-type: none">• Check holes at bottom of dry ice tin• Ensure they are open and unobstructed
Holes in catch bag netting	<ul style="list-style-type: none">• Replace/repair catch bag netting

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