have sufficient residual action to kill adults that later harbour in the tyre or kill larvae or pupae in the water. The effectiveness of aerosol d-penothrin on larvae or pupae should be further examined.

- Only 6 larvae and a pupal skin were collected from a single tyre and preserved in alcohol. It is recommended that samples from all receptacles with water and larvae be collected as separate labelled collections, as this will give a better indication of risk and may indicate other species of mosquitoes.

- In this instance it appears fumigation took place very soon after detection, which is very commendable and will be an important factor in keeping exotic mosquito vectors out of the NT. However if there is a delay, or if there is a sufficient period of time between detection and fumigation, local DHCS medical entomologists can be contacted before fumigation to assist with the collection of adult and larval specimens.

- The local AQIS vector officer put the treatment and enhanced surveillance operations in place quickly and systematically. The notification of the detection to DHCS was very speedy and the increased number of adult traps and ovitraps at Perkins were implemented by AQIS and DHCS rapidly.

- No further evidence of *Ae. albopictus* has been detected in the area following a thorough preliminary joint receptacle survey by AQIS and DHCS at Perkins or other premises within 500m of the overseas docking point. We will not be confident there has been no introduction of *Ae. albopictus* until the end of the extra surveillance measures, and when the additional receptacle survey is undertaken following the next rain event.

### Recommended interim water receptacle treatment for exotic mosquitoes on international foreign fishing vessels arriving in Australia

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**Introduction**

Exotic *Aedes* mosquito larvae are commonly found in receptacles as equipment or cargo that hold or have held water, on overseas vessels arriving in the Northern Territory (NT) of Australia. This applies especially to international foreign fishing vessels (IFFV) from Indonesia, which are commonly intercepted fishing in Australian waters by the Royal Australian Navy (RAN) and Customs and detained in Darwin or Gove harbours. The drinking water storage receptacles aboard these vessels are often found to contain *Aedes aegypti* and *Aedes albopictus* larvae. Drinking water storage receptacles are the most commonly detected type of container to carry exotic mosquito pupae, larvae and eggs into the NT. *Aedes* species eggs are desiccation resistant and can often be present in either water holding or dry receptacles. The eggs are laid just above the water level on the inner surfaces of receptacles. Approved procedures to treat drinking water receptacles only allow the use of chlorine, due to the residue concerns posed by the use of insecticides. These treatments are part of routine quarantine inspection and control procedures on vessels or aircraft in the 400 m quarantine zone around air and seaports.

As part of the previously recommended chlorination procedures, any water holding receptacles were emptied and treated with a chlorine spray to kill possible exotic *Aedes* eggs on inner surfaces. However, the previously recommended receptacle treatments that involved spraying the receptacle surface with a 1% active ingredient (AI) chlorine solution to the point of run-off did not adequately kill 100% of mosquito eggs. This was due to the mosquito eggs not being exposed to the chlorine solution for a long enough period. The vertical position of the treated surface, the large clusters of eggs, the sometimes low relative humidity and the dilution of the chlorine solution are all factors that affected the efficacy of the previous treatment recommendations.

Recent re-evaluations of the efficacy of chlorine against *Aedes aegypti* eggs, as well as the development of new egg treatment methods that use detergents, can be combined to provide an improved interim method of receptacle treatment.
treatment. These recommendations are in response to requests by the Australian Quarantine and Inspection Service (AQIS) for suitable receptacle treatment protocols for drinking water receptacles aboard IFFV’s. These recommendations will also hold for refugee vessels and general vessels carrying cargo that holds water, or other receptacles, from overseas. The recommendations are for procedures to treat drinking water receptacles containing, or likely to contain exotic mosquito pupae, larvae and/or eggs.

**Recommendations (see Figure 1)**

**Collection of larval and adult samples**

When a water storage receptacle breeding site is identified it is important to try and collect larval, pupal and/or pupal skin samples before treating the receptacle. If the IFFV has landed in Australia before being intercepted, the collection of these samples allows an effective risk analysis of an exotic vector incursion to be undertaken. It will also allow a timely and adequate monitoring response to be set up in the event of a suspected or potential incursion, as well as the rapid implementation of any control or eradication procedures that are required if there is a confirmed exotic vector incursion.

**The treatment procedure**

The recommended procedure for the treatment of drinking receptacles aboard IFFVs is to firstly pump, siphon, or pour out the stored water into the sea and to spray the inner receptacle surfaces with a chlorine/detergent solution to kill any eggs that may be present. All mosquito larvae and pupae would be killed by disposal into the sea, and any eggs remaining on the receptacle wall will be killed by the chemical treatment.

The chemical treatment comprises a mixture of 4.8 litres of a liquid sodium hypochlorite solution, that has at least 10% AI, combined with approximately 200 ml of liquid dishwashing detergent. The 10% sodium hypochlorite solution can be purchased as ‘liquid chlorine’ (with at least a 10% AI) from most pool shops. The liquid concentrate detergent can be any major domestic or commercial brand name. The ingredients should be mixed thoroughly in a 5-litre pressure sprayer and applied liberally to the point of run off to all of the inner surfaces of the water storage receptacle. The receptacle should then be sealed with a lid or cover and left to stand. This process should be repeated after 30 minutes. Once the receptacle has been treated twice over a 60 minute period it should remain sealed and let stand for another 24 hours, after which it can be thoroughly cleaned and rinsed.

**Improvements in the treatment procedure**

The 2 major problems with the previous chlorine surface treatment was that the chlorine solution did not remain in contact with the eggs for long enough to kill them, and that the 1% chlorine solution was too dilute to kill large numbers, and clusters of eggs. Recent studies have found that chlorine solutions with a 10% AI rate, when applied to *Aedes* eggs and left in contact with the eggs for at least an hour, and then left to incubate for at least 24 hours in a high humidity environment, can achieve a 100% mortality rate. Other studies have found that by adding detergent to a chlorine solution, the mixture becomes a lot more viscous and can adhere to the walls of the receptacle for a longer period of time.

By increasing the strength of the chlorine solution that is in direct contact with the eggs, as well as increasing the time that the treatment mixture is in contact with the eggs and sealing the receptacle to increase the humidity, these interim treatment procedures will provide a more effective control of *Aedes* eggs in IFFV water receptacles than the previous recommendations. The previous recommendations use only a 1% AI chlorine solution for surface treatment of eggs, which has been shown to be too dilute, as well as too thin so that it runs off vertical surfaces too quickly.

**References**

3. Mosquito Control Association of Australia Inc.

Figure 1. Interim treatment procedures for water receptacles on IFFVs

**Step 1**
Collect larvae, pupae and pupal skins from water storage receptacle.

**Step 2**
Empty, siphon or pump contents of receptacle into sea.

**Step 3**
Prepare chemical treatment mixture in a 5-litre pressure sprayer. The mixture includes 4.8 litres of liquid chlorine solution that has at least a 10% active ingredient, and 200 ml of liquid concentrate detergent. Mix well by agitation of sprayer.

**Step 4**
Spray all interior surfaces of receptacle liberally to run off with chlorine/detergent mixture using a 5 litre pressure spray. Seal receptacle and let stand for 30 minutes.

**Step 5**
Open receptacle and re-spray all interior surfaces of receptacle liberally to run off with chlorine/detergent mixture. Seal receptacle and let stand for another 30 minutes.

**Step 6**
Leave receptacle sealed for another twenty-four (24) hours, allowing eggs to incubate. Rinse and wash receptacle.
Guidelines for the Design, Operation, Management and Maintenance of Aquatic Facilities

Leah Magee, Special Project Officer - Environmental Health, CDC

Aquatic facilities, such as swimming pools, spas and water slides have become an integral feature of Territory life, and many people participate in swimming and other water activities for recreational and health reasons. Improper design, maintenance or operation of public aquatic facilities can result in these premises becoming a source of infection or injury.

The draft Guidelines for the Design, Operation, Management and Maintenance of Aquatic Facilities are currently being finalised and will in future replace the following current standards:

- Water Quality & Hygiene Standard For Spa And Hydrotherapy Pools 1995; and

When implemented, these public health and safety Guidelines will ensure that public aquatic facilities are properly designed, constructed, operated and maintained so as to minimise disease, injury and other health-related complaints associated with their use.

Aquatic facilities may be used by a range of people of all ages, states of health and levels of personal hygiene. People can introduce a range of contaminants to the water body, including body fluids such as saliva, mucus, urine, faeces, perspiration and blood as well as hair, skin and sunscreen lotions. Other introduced environmental pollutants include dust, bird droppings, tree leaves, lawn clippings, make-up water, soil and untreated reticulation water. All of these pollutants can be accompanied by a variety of microorganisms, some of which have the ability to survive and even multiply in recreational water. A number of the microorganisms have the ability to cause infections in various parts of the body, such as the eye, ear, skin and gastrointestinal and nervous systems.

Operators and owners of aquatic facilities therefore need to ensure water treatment processes provide continuous and effective disinfection capable of quickly and effectively killing disease-causing microorganisms to prevent disease transmission. Special care also needs to be taken with spa pools, hydrotherapy pools and other aquatic facilities that operate with elevated water temperatures, as they provide environments that are even more conducive to the survival and growth of disease causing microorganisms.

The correct use of chemicals used to disinfect the body of water is also required, as inappropriate use can cause patrons to suffer irritation of the eyes and skin conditions such as dermatitis.

The Guidelines are aimed primarily at designers, builders and operators of aquatic facilities and will assist DHCS Environmental Health Officers and other agencies.

The Guidelines will also set out in detail DHCS requirements in the following areas:

- administrative provisions
- design and construction requirements
- circulation and water treatment systems
- water quality and testing
- general sanitation and operational requirements
- special requirements for small temporary pools
- minimising the risk of cryptosporidium contamination
- faecal and other body fluid accident policy

It is anticipated that the Guidelines will operate for a lengthy trial period to allow for adequate public consultation before formally replacing current swimming pool standards.

The draft Guidelines will be placed on the departmental website for public comment shortly and are in the process of being advertised and widely distributed for public consultation. For further information or to provide feedback, please contact Xavier Schobben, Director Environmental Health at envirohealth@nt.gov.au.