Zika & West Nile Virus
(Mosquito Control)

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Zika Virus
Mosquitoes and Health Risks in the U.S.

- In the U.S., mosquitoes transmit encephalitis-causing viruses, (i.e. West Nile virus) and canine heartworm
- U.S. is always at risk for outbreaks of new diseases
- Mosquito vectors for Zika, West Nile, Dengue, and Chikungunya viruses are also commonly found in many areas of the U.S.
US States

- 5,746 symptomatic Zika virus disease cases reported
- 5,460 cases in travelers returning from affected areas
- 231 cases acquired through presumed local mosquito-borne transmission
- 55 cases acquired through other routes, including
  - Sexual Transmission (N=52)
  - Laboratory Transmission (N=2)
  - Person-to-person through an unknown route (N=1)
US Territories

- 37,304 Symptomatic Zika virus disease cases reported
  - 147 Cases in travelers returning from affected areas
  - 37,157 Cases acquired through presumed local mosquito-borne transmission
  - Zero (0) Cases acquired through other routes
ESTIMATED potential range of *Aedes aegypti* and *Aedes albopictus* in the United States, 2017

These maps DO NOT show
- Exact locations or numbers of mosquitoes living in an area.
- Risk or likelihood that these mosquitoes will spread viruses.

These maps show
- CDC’s best estimate of the potential range of *Ae. aegypti* and *Ae. albopictus* in the United States.
- Areas where mosquitoes are or have been previously found.
Zika Virus

- Virus transmitted by mosquitoes (Aedes species mosquito (Ae. aegypti and Ae. albopictus)
- Discovered in Uganda 1947, in the Zika Forest
- Outbreaks have been reported in different locations throughout the world
Zika Virus Transmission

Zika is transmitted through:

- Mosquito Bites (Primarily)
- Pregnant Mother to the Fetus
- Infected Blood or Sexual Contact

People serve as the primary vertebrate hosts between Zika virus and mosquitoes.
Symptoms of Zika Virus

- 1 in 5 People Infected With Zika Virus Will Get Sick
  - *If You Are Infected, You Are Still Contagious, Even If You Do Not Have Symptoms*
- Symptoms Begin 2-7 Days After Being Bitten
Microcephaly and Zika Virus

Pregnant Women Infected With Zika Virus Has Been Linked To Microcephaly In Newborns

- Microcephaly Has *Never* Been Linked To A Mosquito Transmitted Virus Until Now
- Leaves Us With Many Questions
- In-Depth Research Currently Underway

**Microcephaly** = Abnormally Small Skull And Incomplete Brain Development
Effects on the Nervous System

Zika Virus Infections Have Also Been Linked To Life-Threatening Nervous System Disorders Such As:

- **Encephalitis** - Swelling Of The Brain And Spinal Cord
- **Guillain Barre' Syndrome (GBS)** - Severe Muscle Weakness
  - May Involve Muscles That Control Eye Movement, Swallowing And Breathing
Zika Virus Risks in the United States

History of Zika

• Zika virus was first discovered in 1947 and is named after the Zika Forest in Uganda.
• In 1952, the first human cases of Zika were detected and since then, outbreaks of Zika have been reported in tropical Africa, Southeast Asia, and the Pacific Islands.
• Zika outbreaks have probably occurred in many locations. Before 2007, at least 14 cases of Zika had been documented, although other cases were likely to have occurred and were not reported.
• Because the symptoms of Zika are similar to those of many other diseases, many cases may not have been recognized.
Protection From Zika Virus

No Vaccines Exist For The Zika Virus

Need To Avoid Being Bitten By Mosquitoes Through:

1. Personal Protection
   ● Insect Repellents, Long Sleeves And Pants, etc.

2. Mosquito Reduction And Elimination
Protection From Zika Virus

No Vaccines Exist For The Zika Virus

Everyone living in or traveling to areas with Zika should take steps to prevent mosquito bites
● Cover exposed skin by wearing long-sleeved shirts and long pants.
● Use EPA-registered insect repellents that contain one of the following active ingredients: DEET, picaridin, IR3535, oil of lemon eucalyptus or para-menthane-diol, or 2-undecanone. Always use as directed.
● Use permethrin-treated clothing and gear (boots, pants, socks, tents). You can buy pre-treated items or treat them yourself.
● Stay in places with air conditioning and window and door screens.
● Sleep under a mosquito bed net if air conditioned or screened rooms are not available or if sleeping outdoors.
● Take steps to control mosquitoes in and around your home.

Mosquito Vectors of Zika Virus
Mosquito Vectors of Zika Virus

• Container-Breeding Mosquitoes
• Live And Breed In And Around Human Dwellings
• Prefer To Feed On Humans
• Also Vector Other Viruses (i.e. Dengue And Chikungunya)

*Aedes aegypti
Yellow Fever Mosquito
*Primary Vector of Zika Virus

Aedes albopictus
Asian Tiger Mosquito
Aedes aegypti
(Yellow Fever Mosquito)

- Lays Eggs Indoors Or Outdoors Within Very Close Proximity To Houses Or Buildings
- Has A Very High Preference For Feeding On Humans
- Daytime Feeders

Silvery lyre-shaped pattern on thorax; white banding on legs

Classic Lyre Shape
Aedes albopictus (Asian Tiger Mosquito)

- Lives Around Human Dwellings
- More Commonly Found Outdoors, Rather Than Indoors
- Commonly Feeds On Humans As Well As A Variety Of Domestic And Wild Animals
- Aggressive Daytime Biters

White Stripe Down The Thorax; White Banding On Legs
Mosquito Biology
Life Cycle of Container-Breeding Mosquitoes

- **Eggs**: 8-14 days
- **Larvae**: 8-14 days
- **Pup**: 8-14 days
- **Adult**: 8-14 days

Diagram showing the life cycle of container-breeding mosquitoes.
Mosquito Eggs

- Laid on the damp inner walls, just above the water line
- Submerged by rainfall or by people adding water
- Can remain viable without any water for several months
- Laid in several different containers, across multiple locations
Mosquito Larvae

- Hatch About 2 Days After Being Submerged
- Float Upside Down Near The Surface
- Breath By Extending Small Tube Through Water Surface
- Feed On Organic Matter
- 4 Instars
Mosquito Pupae

- Swim By Somersaulting Repeatedly
- Do Not Feed
- Must Penetrate The Water Surface To Breathe
Mosquito Adults

- Development Time (Egg To Adult) Ranges 8-14 Days
- Adults Mate Within 1-2 Days After Emergence
Adult Female Mosquitoes

- After Mating, Females Seek Out A Blood Meal
- Average Lifespan Is About 3-4 Weeks
Feeding By Male Mosquitoes

• Male Mosquitoes Do **NOT** Feed On Blood
• Adult Males Feed On Plant Nectar
Mosquito Control
MOSQUITO CONTROL DURING AN OUTBREAK

Why it’s Important to Kill Mosquitoes NOW

When infected adult mosquitoes are spreading a virus to people, acting quickly can stop further spread and prevent more people from getting sick. By using multiple mosquito control methods at the same time, people and communities can help stop an outbreak.

Local government departments and mosquito control districts take the lead for large-scale mosquito control activities to immediately kill infected mosquitoes. You can also take steps to help protect yourself, your family, and your community.
<table>
<thead>
<tr>
<th>MOSQUITO CONTROL ACTIVITY</th>
<th>WHY ACTIVITY IS IMPORTANT</th>
<th>WHAT LOCAL GOVERNMENT DEPARTMENTS OR MOSQUITO CONTROL DISTRICTS CAN DO</th>
<th>WHAT YOU AND PEST CONTROL PROFESSIONALS CAN DO</th>
</tr>
</thead>
<tbody>
<tr>
<td>Use adulticides to kill infected adult mosquitoes</td>
<td>Adulticides are the only way to immediately kill infected adult mosquitoes and stop the spread of viruses.</td>
<td>Depending on the size of the area, use backpack sprayers, trucks, or airplanes to apply adulticides.</td>
<td>Apply adulticides according to label instructions to kill mosquitoes inside and outside homes.</td>
</tr>
<tr>
<td>Prevent mosquitoes from laying eggs and eggs from hatching</td>
<td>Mosquitoes lay eggs near water. Eggs can develop into adults in about a week.</td>
<td>• Collect and dispose of abandoned tires and roadside trash. • Clean up and maintain public spaces like parks and greenways.</td>
<td>• Once a week, empty and scrub, turn over, cover, or throw away items that hold water like tires, buckets, planters, toys, pools, birdbaths, flower pot saucers, and trash containers.</td>
</tr>
<tr>
<td>Use larvicides to stop larvae hatched from eggs from becoming adults</td>
<td>Larvicides kill larvae hatched from eggs. Use only in water that will not be used for drinking and cannot be dumped.</td>
<td>• Treat standing water or storage containers in public places. • Treat standing water on private property as part of a neighborhood cleanup or mosquito control campaign.</td>
<td>• Apply larvicides according to label instructions to fountains, septic tanks, and pool covers that hold water. • Do not treat water that will be used for drinking.</td>
</tr>
</tbody>
</table>
Mosquito Control Steps

1. Inspection
2. Chemical Control (Targets Adults)
3. Applications of Larvicide (Targets Larvae)
4. Reporting
Mosquito Control Steps

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Inspection

• The first step is a thorough inspection of the property for potential mosquito breeding sites

• Inspect for natural and man-made conditions that allow water (rain or irrigation) to collect and lay stagnant on a property

• Naturally-moving water (streams, rivers, brooks) can be ignored, as mosquitoes will not develop in moving water.
Examples of Artificial Breeding Sites

- Birdbaths Or Fountains
- Pet Water Bowls
- Neglected Swimming Pools (Including Covers And Child Wading Pools)
- Toys (Pails, Sandboxes, Riding Toys)
- Discarded Beverage Cans And Bottles
- Discarded Vehicle Tires
- Flower Pots And Planters
- Blocked Gutters, Tarps, And Boat Covers.
Examples of Natural Breeding Sites

- Tree holes, stumps
- Leaf axils, fallen leaves
- Ground depressions (tire ruts)
Examples of Natural Breeding Sites
Clogged Gutters

- Make good breeding sites
- Use binoculars for a quick visual inspection from the ground level
Note Excessive Vegetation

Dense vegetation provides:

- Resting / harborage for adult mosquitoes
- Favorable environments for water collection and well-hidden mosquito breeding sites

Recommend that vegetation is trimmed and lawns mowed
Indoor Inspections

Focus your inspection on:
1. Potential breeding sites - bases of potted plants, flower vases
2. Walls in shady, or undisturbed places (adults)
3. Absence of or broken window and door screens
Inspection: Documentation and Communication!

- Document all potential mosquito breeding sites
- Notify the property owner / resident of conditions conducive to mosquito breeding
- Make recommendations to modify conditions to eliminate or reduce mosquito development
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Targeting Adult Mosquitoes

- Residual barrier treatment around a home or building using a power sprayer or backpack sprayer
- Application to perimeter vegetation, ornamentals and building foundations
- Adult mosquitoes will come into contact with these treated areas when they land to rest.
Mosquito Resting Behavior

Rest on low-lying vegetation to survive daytime conditions

Rest briefly nearby, prior to landing on host

Rest after feeding to eliminate water
Where do mosquitoes rest?

Mosquitoes rest on vegetation in cool, damp, shady areas.
Where should you target your applications for a barrier treatment?

- Ornamentals
- Shrubs
- Mulch beds
- Shady, grassy areas
- Trees and vegetation (up to 10 feet high)
- Building foundations
- Shaded areas on buildings
  - Under eaves and overhangs
- Beneath decks
Product Information

You will use:

- Product with active ingredient in pyrethroid class of insecticides (see Mosquito Program Guide)
- Follow all instructions on the label

Pyrethroid Laws

1. Outdoor applications limited to spot or crack and crevice only, except to soil, turf or vegetation
2. Applications to building foundations are max height of 3 feet
3. Applications beneath eaves, overhangs and around windows/doors, must be C&C or spot treatments
Product Information

• EcoVia EC- products with “natural” active ingredients
• Oil-based---potential to burn plant surfaces
• Use extra caution on very hot days
Product Information: IGRs

• Add an insect growth regulator (IGR) NyGuard to your pyrethroid tank mix to treat adult mosquito resting sites.

• The IGR pyriproxyfen impacts adult mosquitoes by:
  
  o Decreasing reproductive capacity of females - reduces/eliminates egg production and development, as well as egg hatching.
  
  o In container-breeding mosquitoes, gravid females will transfer the IGR to breeding sites, preventing the emergence of adults.
Application Equipment: Power Sprayers & Compressed Air Sprayers

Power Sprayers
• For exterior treatment to all vegetation and building foundations

Compressed Air Sprayers
• B&G, backpack sprayers
• Use for crack and crevice and spot treatments to overhangs, beneath eaves and around windows and doors
Application Equipment: Backpack Mist Blowers

- Mist blowers are ideal application equipment for treating mosquito resting sites.
- Provide better penetrability and coverage of the vegetation compared to backpack sprayers.
Application Techniques

- On vegetation, mosquitoes tend to rest on the undersides of the foliage / leaves
- Therefore coating the undersides of foliage should be your focus...
Application Techniques

Apply materials using an **up and down motion** with your arms, rather than side to side.

- **Up and Down Motion**
- **Side to Side Motion**
Pollinator Protection Concerns

- Avoid flowering plants or plants that are in bloom
- Follow the label

- Is there a potential for drift?
- Is there a specific pollinator concern at that location?

Take all concerns into account and proceed with common sense!
Before Making an Application for a Barrier Treatment

- Remove toys, pet food bowls, clothing, lawn chairs etc. from treatment area
- Take note of vegetable or herb gardens, fish ponds to avoid treating in those areas
- Make sure people and pets are not in treatment area

Follow all instructions on the product label!!!
Mosquito Control Steps

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Larvicide Applications

Apply Larvicide to:

1. Stagnant water, such as a water-filled ditch
2. Water in a container that cannot be easily eliminated, such as a stagnant pool
Prohibited Larvicide Applications

Do NOT Treat:

1. Maintained swimming pools, fountains, reflecting ponds, fish-bearing ornamental ponds
2. Naturally-moving water—streams rivers, brooks, etc.
3. Water that is connected to a waterway or larger body of water
Mosquito Control Steps

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Reporting

Your service reports should include:

✓ All findings that support mosquito-conducive conditions
  ❑ Potential mosquito breeding areas like stagnant water, old tires, clogged gutters and excessive vegetation
  ❑ Lack of window screens or screens in disrepair
  ❑ Make recommendations on how to correct them.

✓ All pesticide applications must be documented, including amounts applied, application methods, mix rates, etc.
Communication with Residents

• Communicate all findings from your service reports to your customers
• Mosquito control is a partnership between the PCO and the customer
• You must work together to remove mosquito harborage and breeding areas!

*Your treatments will not be effective if, for example, the customer does not remove water-filled items because mosquitoes will continue to breed*
West Nile Virus

Mosquito Bite Prevention (United States)

Not all mosquitoes are the same. Different mosquitoes spread different viruses and bite at different times of the day.

<table>
<thead>
<tr>
<th>Type of Mosquito</th>
<th>Viruses spread</th>
<th>Biting habits</th>
</tr>
</thead>
<tbody>
<tr>
<td>Aedes aegypti, Aedes albopictus</td>
<td>Chikungunya, Dengue, Zika</td>
<td>Primarily daytime, but can also bite at night</td>
</tr>
<tr>
<td>Culex species</td>
<td>West Nile</td>
<td>Evening to morning</td>
</tr>
</tbody>
</table>

Protect yourself and your family from mosquito bites
West Nile Virus Activity by State – United States 2018 (December 11, 2018)
West Nile Virus Transmission Cycle

In nature, West Nile virus cycles between mosquitoes (especially Culex species) and birds. Some infected birds can develop high levels of the virus in their bloodstream and mosquitoes can become infected by biting these infected birds. After about a week, infected mosquitoes can pass the virus to more birds when they bite.

Mosquitoes with West Nile virus also bite and infect people, horses and other mammals. However, humans, horses and other mammals are 'dead end' hosts. This means that they do not develop high levels of virus in their bloodstream, and cannot pass the virus on to other biting mosquitoes.
West Nile Virus Transmission Cycle

In a very small number of cases, West Nile virus has been spread through:

- Exposure in a laboratory setting
- Blood transfusion and organ donation
- Mother to baby, during pregnancy, delivery, or breast feeding

West Nile virus is not spread:

- Through coughing, sneezing, or touching
- By touching live animals
- From handling live or dead infected birds. Avoid bare-handed contact when handling any dead animal. If you are disposing of a dead bird, use gloves or double plastic bags to place the carcass in a garbage can.
- Through eating infected birds or animals. Always follow instructions for fully cooking meat from either birds or mammals.
West Nile Virus Symptoms

Symptoms - No symptoms in most people.
Most people (8 out of 10) infected with West Nile virus do not develop any symptoms.

Febrile illness (fever) in some people. About 1 in 5 people who are infected develop a fever with other symptoms such as headache, body aches, joint pains, vomiting, diarrhea, or rash. Most people with this type of West Nile virus disease recover completely, but fatigue and weakness can last for weeks or months.

Serious symptoms in a few people. About 1 in 150 people who are infected develop a severe illness affecting the central nervous system such as encephalitis (inflammation of the brain) or meningitis (inflammation of the membranes that surround the brain and spinal cord).

- Symptoms of severe illness include high fever, headache, neck stiffness, stupor, disorientation, coma, tremors, convulsions, muscle weakness, vision loss, numbness and paralysis.
- Severe illness can occur in people of any age; however, people over 60 years of age are at greater risk. People with certain medical conditions, such as cancer, diabetes, hypertension, kidney disease, and people who have received organ transplants, are also at greater risk.
- Recovery from severe illness might take several weeks or months. Some effects to the central nervous system might be permanent.
- About 1 out of 10 people who develop severe illness affecting the central nervous system die.
Thank You