



State of New Hampshire
Department of Health and Human Services
Division of Public Health Services



West Nile Virus and Eastern Equine Encephalitis (Arboviruses) and Mosquitoes in New Hampshire

Have mosquitoes tested positive for arboviruses in New Hampshire?

Yes. New Hampshire discovered its first positive West Nile Virus (WNV) mosquitoes during the 2001 season, when 3 mosquito pools tested positive. In 2002, there were 33 positive WNV pools, and in 2003 there were 6 WNV positive pools. In 2004 there were no positive WNV pools, but 19 Eastern Equine Encephalitis (EEE) pools were detected. This trend continued in 2005 with one pool testing positive for WNV and 15 pools testing positive for EEE. It is apparent that infected mosquitoes will continue to exist in NH and be active during the summer and early fall.

How are mosquitoes collected for testing?

Mosquitoes are collected primarily in two types of traps:

- *CDC Light traps* are suspended off the ground and a source of carbon dioxide, usually from dry ice, is used as the primary attractant. A small light is also incorporated into the trap. When the mosquito approaches the trap, a battery-powered fan draws the mosquito into the trap netting.
- *Gravid traps* are containers that hold a stagnant water solution. These traps are placed on the ground and attract gravid (pregnant) female mosquitoes. As the female lands to lay eggs, the battery-powered fan draws them up a tube and they are caught in the trap netting.

What is a mosquito pool?

After mosquitoes are collected, they are sorted by species of mosquito, date of collection, and the trap location and are placed in tubes and coded to reflect this information. The tubes are then sent to the NH Public Health Laboratories for testing. This tube is called a "pool." There are no more than 25 mosquitoes in each pool.

How many mosquitoes have been collected for surveillance purposes?

Tens of thousands of individual mosquitoes have been collected over the past four seasons.

What is the time frame when mosquitoes are usually found to be infected?

Since 2001, a seasonal pattern has been clearly established. The earliest positive mosquitoes have been collected in late July and the latest collection has been in mid-September.

When am I at greatest risk for contracting WNV or EEE in New Hampshire?

Any time mosquitoes are actively biting you may be at risk for contracting WNV or EEE. Based on data collected from prior seasons, virus has been detected in mosquitoes from late July through mid-September.

What types of mosquitoes have been found to be infected with WNV in New Hampshire?

The following mosquito species have been trapped and tested positive: *Culex pipiens*; *Culex pipiens/restuans*; *Culex restuans*; *Ochlerotatus canadensis*; *Ochlerotatus japonicus*; *Ochlerotatus triseriatus*; *Coquillettidia perturbans*; *Anopheles punctipennis*; and *Anopheles walkeri*.

What types of mosquitoes have been found to be infected with EEE in New Hampshire?

The following mosquito species have been trapped and tested positive: *Culex pipiens*; *Culiseta melanura*, *Culiseta morsitans*, *Ochlerotatus canadensis*; *Coquillettidia perturbans*; and *Aedes cinereus*.

Do these types of mosquitoes bite humans?

Aedes species - These are sometimes called "floodwater" mosquitoes because flooding is important for their eggs to hatch. They include such species as the yellow-fever mosquito (*Aedes aegypti*) and the Asian tiger mosquito (*Aedes albopictus*). They are strong fliers, capable of traveling great distances (up to 75 miles/121 km) from their breeding sites. They persistently bite mammals, *especially humans*, mainly at dawn and in the early evening. Their bites are painful.

Anopheles - These tend to breed in bodies of permanent fresh water. They include several species, such as the common malaria mosquito (*Anopheles quadrimaculatus*), that can spread malaria to humans.

Culex - These tend to breed in quiet, standing water. They include several species such as the northern house mosquito (*Culex pipiens*). They are weak fliers and tend to live for only a few weeks during the summer months. They persistently bite, *preferring birds over humans*, and usually attack at dawn or after dusk. Their bite is painful.

Culex pipiens/restuans have the highest infection rates.

Culiseta – These tend to breed in fresh water swamps and woodland pools. Three *Culiseta* species have been identified in New Hampshire. They have a flight distance of ½ to 1 mile and can live up to three months. They are moderately aggressive biters and prefer to bite birds. *C. melanura* is the primary vector for EEE.

Some mosquitoes, such as the cattail mosquito (*Coquillettidia perturbans*), are becoming more prevalent pests as humans invade their habitats.

What can I do to reduce the number of mosquitoes on my property?

Here are some steps that you can take:

- Remove all discarded tires from your property. The used tire has become the most important domestic mosquito-breeding habitat in this country.
- Do not allow water-holding containers to collect water. Dispose of tin cans, plastic containers, ceramic pots, or similar water-holding containers. Do not overlook containers that have become overgrown by aquatic vegetation.
- Drill holes in the bottom of recycling containers that are left out of doors. Drainage holes that are located on the sides collect enough water for mosquitoes to breed in.
- Make sure roof gutters drain properly. Clean clogged gutters in the spring and fall.
- Tightly screen "rain barrels" to ensure mosquitoes can't deposit eggs in or on the water.
- Clean and chlorinate swimming pools and outdoor hot tubs. If not in use, keep empty and covered.
- Drain water from pool covers.
- Aerate ornamental pools or stock them with fish. Water gardens are fashionable but become major mosquito producers if they are allowed to stagnate.
- Turn over wheelbarrows and change water in birdbaths at least twice weekly. Both provide breeding habitat for domestic mosquitoes
- Eliminate any standing water that collects on your property. Use landscaping as needed. Mosquitoes will develop in any puddle that last more than 4 days.
- Remind or help neighbors to eliminate breeding sites on their properties.
- Make sure that doors and windows have tight-fitting screens. Repair or replace all screens in your home that have tears or holes.

**For more information,
call the New Hampshire Department of Health and Human Services,
WNV/EEE information line at
1-866-273-NILE (6453)**

**For health care providers with clinical questions
or to report human suspected West Nile virus or Eastern Equine Encephalitis cases
please contact the Bureau of Communicable Disease Control at
1-800-852-3345 ext. 4496**



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Reducing the Risk of Infection from Mosquitoes Around Your Home and Community

What can I do around my home to help reduce exposure to mosquitoes?

Mosquitoes lay their eggs in standing water. Weeds, tall grass, and bushes provide an outdoor home for the common house mosquito that are most often associated with West Nile Virus (WNV). Fresh water swamps and coastal areas provide breeding habitat for the mosquito species commonly associated with Eastern Equine Encephalitis (EEE). Mosquitoes can enter homes through unscreened windows or doors, or broken screens. Here are some steps that you can take:

- Make sure that doors and windows have tight-fitting screens. Repair or replace all screens in your home that have tears or holes.
- Remove all discarded tires from your property. The used tire has become the most important domestic mosquito-breeding habitat in this country.
- Do not allow water-holding containers to collect water. Dispose of tin cans, plastic containers, ceramic pots, or similar water-holding containers. Do not overlook containers that have become overgrown by aquatic vegetation.
- Drill holes in the bottom of recycling containers that are left out of doors. Drainage holes that are located on the sides collect enough water for mosquitoes to breed in.
- Make sure roof gutters drain properly. Clean clogged gutters in the spring and fall.
- Tightly screen "rain barrels" to ensure mosquitoes can't deposit eggs in or on water.
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- Aerate ornamental pools or stock them with fish. Water gardens are fashionable but become major mosquito producers if they are allowed to stagnate.
- Turn over wheelbarrows and change water in birdbaths at least twice weekly. Both provide breeding habitat for domestic mosquitoes
- Eliminate any standing water that collects on your property. Use landscaping as needed. Mosquitoes will develop in any puddle that lasts more than 4 days.
- Remind or help neighbors to eliminate breeding sites on their properties.

Please Note: Although certain pesticide products are available for sale in the marketplace to control mosquito larvae, one must obtain a special permit from the Department of Agriculture, Division of Pesticide Control to be able to apply pesticides to any surface waters in the State of New Hampshire. Questions regarding how to apply for such special permits may best be directed to the New Hampshire Department of Agriculture, Division of Pesticide Control at 603-271-3550.

What can I do to reduce my risk of becoming infected with WNV or EEE?

When mosquitoes are active, take the following precautions:

- Protective clothing such as long pants, long-sleeved shirts, and socks should be worn if you are outside during evening, nighttime, and dawn hours, the time when mosquitoes are most active, and at other times when mosquitoes are biting.
- If you are outside during evening, nighttime, and dawn hours, or whenever mosquitoes are biting, consider the use of an effective insect repellent.
- **Use repellents according to manufacturer's directions.**
 - Repellents containing DEET (N, N-diethyl-methyl-meta-toluamide) have been proven effective. No more than 30% DEET should be used on adults or children.
 - The American Academy of Pediatrics (AAP) Committee on Environmental Health has updated their recommendation for use of DEET products on children, citing: "Insect repellents containing DEET with a concentration of 10% appear to be as safe as products with a concentration of 30% when used according to the directions on the product labels." AAP recommends that repellents with DEET should not be used on infants less than two months old.
 - Repellents containing Picaridin (KBR3023) or oil of lemon eucalyptus (a plant-based repellent) provide protection similar to repellents with low concentrations of DEET. Oil of lemon eucalyptus should not be used on children under the age of three years.
 - Do not allow young children to apply repellent themselves.
 - Do not apply repellent directly to children. Apply repellent to your own hands and then put it on the child's exposed skin.
 - Avoid putting repellent on the hands of children or near their eyes and mouth.
 - Do not spray directly on the face, spray into the hands first and then apply to the face.
 - Do not apply to cuts, wounds, or irritated skin.
 - Do not use under clothing.
 - Do not spray repellent-containing products in enclosed areas.
 - Avoid prolonged or excessive use of repellents. Use sparingly to cover exposed skin and clothing.

- Wash all treated skin and clothing after returning indoors.
- Store repellents out of reach of children.
- Vitamin B, ultrasonic devices, incense, and bug zappers have not been shown to be effective in preventing mosquito bites.

More information on mosquito repellents is available for physicians in the following technical articles:

Mark S. Fradin, MD, and John F. Day, PhD. Comparative Efficacy of Insect Repellents against Mosquito Bites. *New England Journal of Medicine*, Volume 347:13-18, July 4, 2002 Number 1.

D.R. Barnard and R.D. Xue. Laboratory Evaluation of Mosquito Repellents Against *Aedes albopictus*, *Culex nigripalpus*, and *Ochlerotatus triseriatus* (Diptera: Culicidae). *Journal of Medical Entomology*, Volume 41(4):726-30, July 2004.

What health risks are posed to people and pets from pesticides?

If a community decides to use control measures such as pesticide application, the products that will be applied will be used according to integrated pest management guidelines set by the U.S. Environmental Protection Agency. In the small amounts used, these pesticides would pose negligible risks to people and to pets. Residents will learn about spraying schedules through different mechanisms that may include public service announcements, the media, the DHHS and DES websites, a telephone information line, and local authorities.

**For more information,
call the New Hampshire Department of Health and Human Services,
WNV/EEE information line at
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Control of Adult Mosquitoes to Reduce Transmission of West Nile Virus and Eastern Equine Encephalitis

Why spray for mosquitoes?

Transmission of the West Nile Virus (WNV) and Eastern Equine Encephalitis (EEE) occur through mosquito bites. Control of the mosquito population will help reduce transmission and spread of the virus. Birds infected by mosquito bites can carry these viruses into areas that are currently virus-free. Mosquitoes feeding on these infected birds can then become vectors to transmit these viruses to other birds, mammals (e.g., dogs, cats, horses), or humans. Reduction of mosquitoes can therefore reduce the transmission of WNV and EEE at several different levels.

The life cycle of a mosquito consists of four distinct stages: egg, larva, pupa, and adult. Control of mosquitoes at each stage of development requires different pesticides with different methods of application. Mosquito spraying is targeted at adult mosquitoes and this fact sheet is intended to address questions related to the spraying of mosquitoes with “adulticides.”

When could pesticide application occur?

Cities and towns in New Hampshire may spray for mosquitoes if such a decision is made based upon the presence of WNV or EEE in mosquitoes, birds, animals, or humans within the community.

Where and how could the pesticides be used?

Applications made on the ground may be made on foot, using backpack sprayers, or by vehicle, using ultra-low volume (ULV) sprayers mounted on trucks. Aerial applications will be considered as a method of last resort when it becomes evident that a spray program will need to be implemented that covers broader or more remote areas than can reasonably be addressed through ground applications.

How will I be notified if it is decided that spraying is necessary in my neighborhood?

Should spraying be deemed necessary, whoever holds the required permit to apply (typically the local municipalities) will alert people of the spraying schedule as early as possible. Likely forms of notification would be by best available means, which may include one or more of the following: notice(s) in the newspapers, announcements on the radio and/or television, or notification by telephone or mail, etc. If the need to spray is identified, efforts will be made to

initiate spraying as quickly as possible (possibly within 48 hours). The applicant is required by the Division of Pesticide Control to notify town officials and the public at least 24 hours in advance of spraying.

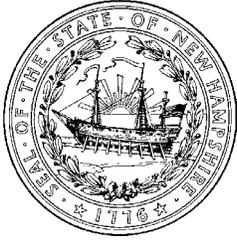
What pesticides will be used for mosquito spraying?

Applicators may use one of several different pesticide products for mosquito spraying. The specific agent will depend on a number of factors including application environment, immediate availability of the product, and cost. However, the pesticides of choice that are currently registered for this type of use in New Hampshire are primarily pyrethroid-based products. Pyrethroids are a group of synthetic pesticides similar to the natural pesticide pyrethrum (pyrethrins) produced by chrysanthemum flowers. Pyrethroids are more effective than the natural pyrethrins and they are effective against adult mosquitoes that transmit WNV and EEE.

**For more information or to report dead birds, call the
New Hampshire Department of Health and Human Services,
WNV/EEE information line at
1-866-273-NILE (6453)**

**For general information on pesticides,
please call the NH Department of Agriculture, Pesticides Division
at 1-603-271-3550.**

**For more information about potential health effects of pesticide exposure,
please call the NH Department of Environmental Services at
1-800-852-3345, ext. 4664, or 1-603-271-4664.**



Larvicides

What are larvicides?

Larvicides are chemicals or natural bacteria that can be applied to kill mosquito larvae.

What are larvae?

Larvae are one of the four stages in a mosquito's development. Adult female mosquitoes lay eggs, which hatch into larvae. Larvae then become pupae, from which the adult mosquitoes emerge. Adult mosquitoes lay their eggs on the surface of standing water and the larvae then develop into pupae in the water.

In what form are larvicides used?

Larvicides can be applied to standing water as liquid, a spray, or granules. Some formulations release a concentrated larvicide slowly over weeks to months and they are useful in catch basins (storm drains) in which standing water has developed. These products will be placed into the storm drains by hand. For other types of standing water, granules or liquid products may be applied either by hand, or sprayed from backpacks or trucks.

Are larvicides any better at killing mosquitoes than pesticides that attack adult mosquitoes (adulticides)?

Larvicides are more effective at controlling mosquitoes because they kill mosquitoes before they become adults and disperse.

What types of larvicides will be used to combat the spread of mosquitoes with the West Nile Virus or Eastern Equine Encephalitis?

Common larvicides include Altosid (*Methoprene*), VECTOLEX (*Bacillus sphaericus*), and VECTOBAC (*Bacillus thuringiensis israelensis*). These products have been approved for mosquito control by the United States Environmental Protection Agency (U.S. EPA). Altosid mimics an insect growth hormone and prevents the development of adult mosquitoes from pupae. VECTOLEX and VECTOBAC contain bacteria that can damage the gut of the mosquito larvae that feed on them, causing the larvae to starve to death. All three have been found to be highly effective in mosquito control.

When will these larvicides be used for mosquito control?

Depending on the location in New Hampshire and conditions that determine the risk for WNV/EEE transmission, initial application of the larvicides will take place during the last two weeks of April and through mid-May of any given year. Follow-up applications will take place

periodically afterward, and after heavy rains. Some areas will not receive persistent larvicide applications to protect sensitive aquatic and wild life.

If we use larvicides for mosquito control now, does that mean the use of pesticides for adult mosquitoes won't be needed later on?

The use of larvicides is part of the first line of defense against mosquitoes carrying WNV and EEE. A preventive approach also includes encouraging residents to eliminate standing water areas around residences where mosquitoes breed and placing fish that eat mosquito larvae in some areas. In the event of a public health threat, reducing the adult population of mosquitoes with EPA-approved pesticides will be done when necessary to prevent or address the potential for illness in humans.

Am I likely to be exposed to these larvicides?

No. The larvicides are being applied in storm drains, catch basins, and other areas to which the general public does not have access. Larvicides will not be applied in areas that drain into waters consumed by humans.

What problems could I have if I am exposed to these larvicides?

Altosid, as well as VECTOLEX and VECTOBAC, can cause mild eye and skin irritation, but mostly through direct contact with highly concentrated forms of these agents. The application of these products is done in areas inaccessible to the public and at low concentrations.

What should I do if I am exposed to these larvicides?

If you experience eye or skin irritation as a result of exposure to a larvicide, rinse your eyes with tap water for 20 minutes and wash your skin thoroughly with soap and water. If the symptoms persist, first contact your local doctor or emergency department, then contact the New Hampshire Poison Control Center at 1-800-222-1222.

For more information about potential health effects from exposure to larvicides, such as Altosid, VECTOBAC and VECTOLEX, please call the NH Department of Environmental Services, at 1-800-852-3345, ext. 4664.

For more information about WNV/EEE, call the New Hampshire Department of Health and Human Services, WNV/EEE information line, at 1-866-273-NILE (6453).



Pyrethroid Insecticides for Mosquito Control

What pesticides could be used for mosquito spraying?

Licensed pesticide applicators may use one of several different pesticide products for mosquito spraying. The specific agent will depend on a number of factors including application environment, immediate availability of the product, and cost. However, the pesticides of choice that are currently registered for this type of use in New Hampshire are primarily pyrethroid-based products. Pyrethroids are a group of synthetic pesticides similar to the natural pesticide pyrethrum (pyrethrins) produced by chrysanthemum flowers. Pyrethroids are more effective than the natural pyrethrins and they are effective against adult mosquitoes that transmit West Nile virus (WNV) and Eastern Equine Encephalitis (EEE) virus. The pyrethroid insecticide active ingredients sumithrin (e.g., in the product Anvil), resmethrin (e.g., in the product Scourge), and permethrin (e.g., in the product Biomist) are the agents most likely to be used for spraying in New Hampshire. These pesticides are approved by the United States Environmental Protection Agency for control of adult mosquitoes in both urban and rural residential environments.

Humans (and other mammals) have the ability to rapidly break down (i.e., detoxify) pyrethroids and remove them from their bodies. Insects are less capable of detoxifying pyrethroids and are therefore more sensitive to these agents. To further increase effectiveness against insects, pyrethroid-based pesticides commonly contain piperonyl butoxide (PBO). PBO is not a pesticide; rather it enhances the insecticidal activity of the pyrethroid by further decreasing the insect's ability to detoxify the pesticide. Anvil, Scourge, and various other pyrethroid-containing insecticides contain PBO.

Are pyrethroid insecticides harmful to human beings?

In general, at the concentrations used, most people would not be expected to experience any symptoms. Upon direct contact with pyrethroid-containing products, some people may develop temporary skin irritations, stuffy or runny nose, or mild respiratory, throat, or eye irritation. Based on experience from past applications of pyrethroid-containing products for nuisance control of mosquitoes using ultra-low volume (ULV) sprayers mounted on trucks, state officials in New Hampshire have received very few complaints of symptoms from citizens in the areas where applications occurred. People with existing respiratory conditions, such as asthma, are encouraged to stay indoors during spraying since these products may aggravate those conditions.

What precautions should be taken to protect against pesticide exposure during spraying?

If spraying were to occur, the New Hampshire Department of Health and Human Services recommends that all individuals take the following precautions to avoid direct exposure to pesticides and reduce the risk of any reactions to pesticides:

- Some individuals are sensitive to pesticides. Persons with asthma or other respiratory conditions are especially encouraged to stay inside during spraying since there is a possibility that spraying could worsen those conditions.
- Whenever possible, stay indoors during spraying.
- Close windows and doors and turn off air conditioning units.
- Remove children's toys, outdoor equipment, and clothes from outdoor areas. (If toys are left outside, wash with soap and water before using again.)
- Prevent children from accessing the immediate spray area for approximately 1 hour after spraying to allow drying of any pesticide residue.
- Wash skin and clothing exposed to pesticides with soap and water.
- Wash any fruit and vegetables exposed to the spray before eating them.
- Anyone experiencing adverse reactions to pesticides should call their doctor or the Poison Control Center at 1-800-222-1222.

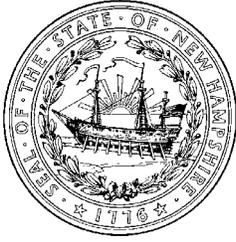
Are pyrethroids safe for the environment?

Pyrethroids have a relatively low persistence in the environment and break down very quickly in sunlight. They readily bind to soils and thus are not expected to contaminate groundwater. Pyrethroids are toxic to bees, fish, and other aquatic life forms and are not to be applied to bodies of water. Beehives should be covered with burlap and kept moist during the spraying and for two to three hours after the spraying has occurred.

**For more information about WNV or EEE call the
New Hampshire Department of Health and Human Services,
WNV/EEE information line
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VECTOBAC

(Bacillus thuringiensis israelensis)

What is VECTOBAC?

VECTOBAC is a larvicide that can kill mosquitoes during the larval stage of development. It contains a naturally occurring bacteria (*Bacillus thuringiensis israelensis*) that is common in soils in the United States and throughout the world. VECTOBAC has been used since the 1950s for insect control, particularly for mosquitoes, black flies, and fungus gnats.

How does VECTOBAC work?

To control mosquito larvae, granules or briquets of VECTOBAC are placed in standing water areas where mosquitoes breed, such as storm water and drainage systems (catch basins), marine and coastal areas, ponds, pool covers, large puddles, and discarded automobile tires. This bacteria damages the gut of the mosquito larvae when they eat it, causing the larvae to starve to death. A briquet is the solid block of VECTOBAC that releases concentrated larvicide for weeks to months.

Is VECTOBAC harmful to human beings?

No. There are no reports of serious acute or chronic effects of VECTOBAC from inhalation, but mild skin and eye irritation have been reported from direct contact with this agent. Eating plants or drinking water exposed to VECTOBAC has not been shown to produce any ill effects in humans.

How safe is VECTOBAC for the environment?

The bacterium contained in VECTOBAC occurs naturally in the soil and is harmless to mammals. It may be toxic to moths, butterflies, certain beetles, and some flies. It may be toxic to freshwater fish, but additional research needs to be done to confirm this. More data need to be collected regarding the effects of VECTOBAC on birds and other non-mosquito insects.

Is it safe for children and pets to play in areas that have been treated with VECTOBAC?

Mild skin and eye irritation can occur with direct contact, and it is best to keep children and pets away from areas that have been treated. However, since it will mostly be placed in storm drains and catch basins, children and pets will generally not have access to areas where VECTOBAC has been placed.

Am I likely to be exposed to VECTOBAC?

No. These larvicides are being applied in storm drains, catch basins, and other areas to which the general public does not have access. These areas drain into river water and sewage treatment plants.

Can I use this VECTOBAC product around my home?

No. VECTOBAC can only be applied by licensed applicators.

What should I do if I am exposed to VECTOBAC?

If you experience eye or skin irritation as a result of exposure to VECTOBAC, irrigate your eyes with tap water for 20 minutes and wash your skin thoroughly with soap and water. If the symptoms persist, first contact your local doctor or emergency department, then contact the New Hampshire Poison Control Center at 1-800-222-1222.

For more information about potential health effects from exposure to pesticides, such as VECTOBAC, please call the NH Department of Environmental Services at 1-800-852-3345, extension 4664, or 1-603-271-4664.

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