

# **The State of Vermont**

## **Arbovirus**

### **Surveillance and Response Plan**

This plan is based upon CDC's "Epidemic/Epizootic West Nile Virus in the United States: Guidelines for Surveillance, Prevention, and Control", the "2012 Massachusetts Arbovirus Surveillance and Response Plan", "New York State West Nile Virus Response Plan", "The State of Connecticut West Nile Virus Surveillance & Response Plan", and the "The 2012 New Hampshire Arboviral Illness Surveillance, Prevention and Response Plan" . This plan was originally created in 2003 and has been reviewed and updated periodically.

Revised: June 2015

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## Introduction

This revision of the Vermont Arbovirus Surveillance Plan is focused on responding to Eastern equine encephalitis (EEE) virus, which was the cause of human illness for the first time in Vermont in 2012. The 2012 plan had been an update of the original 2003 West Nile Virus Surveillance and Response Plan and reflected the latest information about West Nile virus (WNV) and included expanded surveillance for EEE virus. In 2010, EEE virus was first detected in Vermont by a survey of deer blood collected during hunting season. In 2011, a flock of emus in Vermont became ill with EEE. This plan includes information about mosquito and veterinary surveillance for EEE. This plan also includes guidance about the response to a positive EEE finding. .

In November 1999, the CDC developed guidelines to direct West Nile virus surveillance, prevention, and control efforts in the eastern United States (<http://www.cdc.gov/mmwr/preview/mmwrhtml/mm4902a1.htm>). Revised national guidelines were issued in 2001 and again in 2003 (<http://www.cdc.gov/ncidod/dvbid/westnile/resources/wnv-guidelines-apr-2001.pdf>). This State of Vermont Arbovirus Surveillance and Response Plan incorporates CDC's guidelines and the recommendations of the Vermont Agency of Agriculture and Department of Health to guide the state's disease prevention activities.

## Background Information on West Nile Virus

West Nile virus (WNV) is a virus that can infect a wide range of vertebrates. It is closely related to the virus that causes St. Louis encephalitis (SLE). WNV was first isolated in the West Nile province of Uganda in 1937. The first recorded epidemic occurred in Israel during 1951-1954. WNV has a widespread distribution in Africa, West Asia, and the Middle East. Large human epidemics of WN encephalitis have been recorded in South Africa in 1974 and in Israel in 2000. Additional human epidemics occurred in southern France in 1962, in southeastern Romania in 1996, and in south central Russia in 1999. Equine outbreaks occurred recently in Italy in 1998 and in France in 2000.

In late summer 1999, the first domestically acquired human cases of WN encephalitis were documented in the United States in the New York City metropolitan area. During the outbreak WNV-infected birds, mosquitoes and horses were also documented. The discovery of overwintering adult *Culex* mosquitoes infected with WNV during the winter of 1999-2000 predicted renewed virus activity for the spring of 2000 (<http://www.cdc.gov/mmwr/preview/mmwrhtml/mm4909a2.htm>). Since 2000, WNV infections have been documented in all 48 contiguous states with a peak in human cases in 2003. WNV had been declining nationally, but in 2012 there was a sharp increase in the number of recognized cases. In Vermont, WNV activity peaked in 2002 and 2003 (see Tables 1 and 2) but there has been a small resurgence of reported cases in since 2011.

The majority (approximately 80%) of individuals infected with WNV experience no symptoms. Approximately 20% of those infected develop a mild febrile illness. Less than one

percent of those infected with WNV develop severe illness, such as encephalitis or meningitis, which can be fatal in a small percentage of cases. People over 50 years of age and those with weakened immune systems are at greatest risk for severe illness due to WNV infection. Among the patients in the 1999 New York outbreak, approximately 40 percent of those with encephalitis or meningitis also had severe muscle weakness.

While the vast majority of human infections with WNV are mosquito-borne, other mechanisms of transmission can occur. Of the 24,656 cases reported to CDC during 2003--2008, 11 (0.04%) were reported as having been acquired in a laboratory setting. Although not confirmed as the source of infection in all cases, 36 (0.1%) patients with WNV disease had received a blood transfusion or organ transplant within 30 days of illness onset. Since 2003, 124 cases of WNV occurred in pregnant women, which resulted in two infants acquiring the infection in utero. Although nine cases were reported to have been in breastfed infants, the probable source of infection in most of these instances was considered to be mosquitoes, not breastfeeding.\*

Like humans, horses infected with WNV can experience asymptomatic infection or illness that can be mild or severe. Approximately one third of horses that develop severe illness die or are euthanized. However, the availability of a West Nile virus vaccine for horses has greatly reduced the number of cases.

WNV is maintained in nature in a mosquito-bird-mosquito transmission cycle primarily involving *Culex* species mosquitoes, particularly *Cx. pipiens*, *Cx. tarsalis*, and *Cx. quinquefasciatus*. Birds are the natural reservoir hosts for WNV. When infected with WNV, many avian species develop transient viremia levels that are high enough to infect feeding mosquitoes. Many species of birds commonly survive their infections and develop permanent immunity, but many other species become ill and die.† Birds in the family Corvidae (e.g., crows, blue jays, ravens) are particularly susceptible to the virus, with a mortality rate greater than 90 percent. For this reason, surveillance for dead birds (especially corvids) infected with the virus is the most sensitive method of detecting the presence of WNV in an area. In addition, dead bird surveillance is an economical method for conducting surveillance statewide.

West Nile virus is maintained in nature primarily by *Culex* mosquito species, which preferentially feed on birds. Numerous other mosquito species have been shown experimentally to be competent vectors for WNV. It is not clear which species play the most important role in human transmission. Different breeding (e.g., in small containers versus in floodwaters) and host-seeking (e.g., preference for birds versus mammals) behaviors of mosquito vector species have important implications for WNV prevention and control. The goal of mosquito surveillance is to determine the distribution, population dynamics, and larval breeding habits of mosquito vectors. Mapping and monitoring larval habitats provides the information required to eliminate mosquitoes at the source through targeted larviciding.

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\* Surveillance for Human West Nile Virus Disease --- United States, 1999—2008, MMWR Surveillance Summaries; 59(02);1-17

† ibid

Trapping and identifying adult mosquitoes provides information on the distribution and relative abundance of mosquito species that are potential vectors of WNV. However, resources for mosquito trapping and testing have diminished so that it is no longer possible to conduct adequate mosquito surveillance for WNV. Therefore, trapping and testing of WNV competent mosquito vectors will be limited. Resources will be focused on trapping and testing in response to the detection of virus in a mammal.

<u>Year</u>	<u>Total Cases Reported to CDC</u>	<u>Neuroinvasive Disease Cases</u>	<u>Presumptively viremic blood donors (PVDs)</u>
2014	2122	1283	337
2013	2469	1267	431
2012	5674	2873	703
2011	690	474	130
2010	1,021	629	144
2009	720	373	116
2008	1,356	689	174
2007	3,630	1,227	352
2006	4,269	1,495	361
2005	3,000	1,309	417
2004	2,539	1,148	224
2003	9,862	2,866	714
2002	4,156	2,946	NA
2001	66	64	NA
2000	21	19	NA
1999	62	59	NA

<b>Indicator</b>	<b>2000</b>	<b>2001</b>	<b>2002</b>	<b>2003</b>	<b>2004</b>	<b>2005</b>	<b>2006</b>	<b>2007</b>	<b>2008</b>	<b>2009</b>	<b>2010</b>	<b>2011</b>	<b>2012</b>	<b>2013</b>	<b>2014</b>
<b>Veterinary</b>	0	0	5	4	0	2	0	0	0	0	0	0	2‡	1	0
<b>Birds</b>	1	0	125	116	9	4	9	3	1	4	1	16	NA	NA	NA
<b>Mosquito pools</b>	0	0	11	0	7	2	0	0	1	12	9	3	1	28	8
<b>Humans</b>	0	0	1	3	0	0	0	0	0	0	0	2	3	2	0
<b>Total</b>	1	0	142	123	16	8	9	3	2	16	10	21	4	31	8

‡ Two alpacas tested positive for antibodies against WNV in 2012. All other veterinary cases were horses.

# Background Information on Eastern Equine Encephalitis Virus

Eastern equine encephalitis virus (EEE) is an alphavirus that, like WNV, is transmitted by mosquitoes. The virus has been found in many species of wild birds, including most passerine birds (perching song birds, such as jays, warblers, finches and sparrows). The virus is passed among wild birds by mosquitoes, especially of the species *Culiseta melanura*. This mosquito reproduces in freshwater hardwood swamps. *Culiseta melanura* mostly bites birds, and it is not known if it is an important vector for human or equine infection. Mosquito species that bite both birds and mammals are considered “bridge” species and may be the source of transmission of EEE virus to mammals. *Aedes*, *Ochlerotatus*, *Coquillettidia* and *Culex* species are potential bridge vectors.

EEE virus is well-established in North America, and outbreaks in horses have been recorded as early as 1831. Human cases are relatively uncommon, with 270 reported between 1964 and 2010. Most of the EEE viral activity has occurred in the Atlantic and Gulf Coast states, and most human cases have occurred in Florida, Georgia, New Jersey and Massachusetts. Epizootics have also occurred in Michigan, Indiana and Ohio.

Vermont had two human cases reported in 2012, which was the first time that a human case had ever been reported in the state. It had been suspected that EEE virus could be in Vermont because it had recently been documented in New Hampshire, northeastern New York and Quebec. Two horses tested positive for EEE virus in Clinton County, New York in 2008, and the same year veterinary cases of the virus were documented in Quebec. In 2009, Maine had an outbreak in horses, with many cases occurring in the central part of the state in areas where EEE virus had never been detected before. Vermont has hardwood swamps that provide the proper habitat for the primary mosquito vector, *Cs. melanura*, and this species has been found in several areas of the state.

The first evidence that the virus was present in Vermont was obtained from a deer and moose serosurvey project begun in 2010. In that year, evidence of exposure was found in about 10% of the deer and moose sampled. Positive deer and moose were distributed widely throughout the state with no evidence of clustering in any areas. In 2011, an emu flock in Vermont was infected with this virus which is further evidence that EEE virus is present in the state. In 2013, mosquito surveillance was increased and EEE virus was detected in 22 mosquito pools, all except one collected from Addison and Rutland Counties. No human cases were reported, but two horses in Franklin County died from this disease. This was the first time EEE was found to be a cause of illness in this county.

In humans, EEE can vary from asymptomatic to severe illness with encephalitis. It is one of the deadliest mosquito-borne diseases in the US with a mortality rate of approximately 35%. In addition, about half of people who survive have some degree of permanent neurologic damage, which can be severe in some cases.

EEE virus causes a severe neurologic disease in horses and other equids. Mortality in unvaccinated horses approaches 90%. Signs and symptoms in horses include fever, depression, anorexia, ataxia, limb weakness or paralysis, blindness, irritability, and sudden death. Alpacas and llamas are also susceptible to EEE virus. EEE virus can also cause a

serious disease in emus and other ratites. However, in these species, symptoms of hemorrhagic gastroenteritis predominate.

Surveillance for EEE virus will include trapping and testing of adult *Cs. melanura* and other competent vector species, testing of veterinary samples from symptomatic domestic animals, and surveillance for human illness.

## Plan of Action

The presence of West Nile virus in Vermont was first documented in October 2000, when a hermit thrush found dead in southern Vermont tested positive for the virus. In 2002, WNV activity was widespread in Vermont, with 11 of 14 Vermont counties documenting at least one positive surveillance indicator. Since then, evidence of WNV has been found in every county. Eastern equine encephalitis virus was first detected in Vermont in 2010 through a deer serosurvey. Since then it has been documented in people, domestic animals or mosquitoes in four counties.

*Culex* mosquito species and *Culiseta melanura* are known to occur in Vermont (Graham AC, Turmel JP, Darsie RF. New state mosquito records for Vermont including a checklist of the mosquito fauna. J. Amer. Mosquito Control Assoc. 1991;7:502-503). Both of these genera are found throughout Vermont, wherever targeted trapping in the preferred habitat has been done. *Culex pipiens* and *Culex restuans* are well established and common in Vermont, taking advantage of any natural or artificial container for breeding. *Culiseta melanura* has been documented in 9 out of 14 counties, ranging from Franklin County to Bennington and Windham counties.

Information gathered from surveillance activities will inform local policy makers about the level of virus activity and the potential threat to human health. This plan allows the state and local government the flexibility to respond to local situations. The goal of the State of Vermont Arbovirus Surveillance and Response Plan is to protect public health from an outbreak of WNV or EEE virus. To accomplish this goal, emphasis will be placed on public education about the transmission of these viruses, elimination of mosquito breeding habitats, and personal preventive measures to prevent or reduce the risk of exposure.

Widespread adult mosquito suppression programs will only be considered as a last resort if surveillance data suggest an increasing and significant risk to human health. Decisions for public health action will be informed by interpretation of the available surveillance data and a number of additional factors, including:

- a) Current weather;
- b) Season of the year (i.e., how long the transmission risk can be expected to persist until mosquito activity decreases);
- c) Feasibility of the planned activities;
- d) Public input on planned activities;
- e) Ecology of the area (e.g., key habitat types);
- f) The human population at risk (urban versus rural, a consideration of the relative risk of pesticides versus arbovirus infection); and
- g) Vector species known or believed to be of importance in the area.

The anticipated benefits of using pesticides versus the risk of harm to people and the environment from their use, as well as the factors listed above, will be considered. If the use of pesticides to control arboviruses is anticipated, steps will be taken to inform the local community and to address community concerns.

An Arboviral Task Force was convened in August 2000 to assign individuals and agencies responsible for the activities detailed in this plan. Members of the task force included the Secretary of Agriculture, the Commissioner of Health, the State Epidemiologist, the State Public Health Veterinarian, the State Entomologist, the State Agricultural Veterinarian, epidemiologists from the Department of Health, and representatives from the State Public Health Laboratory, the Public Affairs Office at the Department of Health, and the Pesticide Advisory Council. Members of these groups continue to work together on the surveillance and response to arboviral diseases.

This plan is designed to be part of an overall plan for vectorborne disease management in Vermont. According to the CDC, every state should have, at a minimum, a functional arbovirus surveillance and response capability. Vector surveillance data are critical for determining the appropriate response to a vectorborne outbreak, and also for targeting vector suppression efforts (<http://www.gao.gov/new.items/he00180.pdf>). However, mosquito surveillance is resource intensive, and available funding supports only limited surveillance. Surveillance efforts will be focused on detecting EEE virus, which was only recently documented in Vermont.

The plan is based upon the most up-to-date scientific information available. Knowledge gained from subsequent surveillance and research data, both nationally and in Vermont, may result in revisions to this plan. This current revision of the plan was reviewed by the State Epidemiologist, the State Public Health Veterinarian, the State Entomologist and the State Veterinarian.

# Components of the Plan

## A. Education:

Education of healthcare providers, veterinarians and the general public about arboviral illnesses is a key focus of this plan. Each spring and early summer a set of core educational materials will be updated and distributed as appropriate. Education outreach will consist of press releases, VT-Health Alert Network (HAN) alerts, posted information on VDH's website, published information in the Infectious Disease Bulletin, emails, and other appropriate methods. Additional educational efforts should be done in response to positive surveillance indicators.

Routine core educational activities:

1. Develop educational messages with emphasis on personal protective measures for groups at highest risk for serious illness (i.e., individuals over 50 years of age) and on the importance of eliminating mosquito breeding sites. (Vermont Department of Health (VDH), Vermont Agency of Agriculture, Food and Markets (VAAFMM))
2. Update the Department of Health's West Nile Virus and Eastern Equine Encephalitis Fact Sheets as indicated. (VDH)
  - a. Keep VDH's WNV and EEE web pages up to date.
  - b. Communicate information to the public as needed, including
    1. minimizing exposure to arbovirus vectors,
    2. the importance of public cooperation in reducing mosquito breeding sites,
    3. integrated pest management for controlling mosquito populations,
    4. the proper use of insect repellants,
    5. the agencies responsible for suppression project activities,
    6. how to protect susceptible pets and livestock from illness
  - c. Respond to public inquiries. (VDH, VAAFMM, USDA Wildlife Services(WLS))
  - d. Educate healthcare providers about testing and reporting of arboviral diseases. (VDH)
  - e. Educate veterinarians about testing and reporting of arboviral diseases in animals. (VDH, VAAFMM)

## 3. Surveillance

### 4. **Avian mortality associated with WNV infection.**

- a. Avian mortality reports and dead bird testing have proven to be a sensitive way to determine if WNV is present in a geographic area. Vermont has detected WNV in dead birds in most years since surveillance began. However, due to a decrease in federal support, the dead bird surveillance program was discontinued in 2012. If resources allow, this program may be reinstated.

### 5. **Passive human surveillance for arboviral illness.**

- a. Disseminate information about the arbovirus surveillance system to health care providers around the state. (VDH)
- b. Maintain surveillance data on reportable suspect cases. (VDH)
- c. Coordinate the testing of specimens for arboviruses as appropriate. This may include obtaining samples for confirmatory testing by a public health laboratory. (VDH)
- d. Provide information on the number of human cases to the public and local officials. (VDH)
- e. Report human surveillance data to the CDC. (VDH)
- f. Active surveillance for human cases will be considered if surveillance data indicate increased risk for human illness, or if a human case is identified.

#### Who should be tested for arboviral illness

Hospitalized patients with encephalitis, meningitis of suspected viral origin, or Guillain-Barré syndrome should be tested. Patients meeting these criteria can be tested through the Vermont Department of Health Laboratory (VDHL). VDHL cannot offer testing for persons with milder illness, such as fever or headache, but testing is available through commercial laboratories.

Specimens should be submitted through local laboratory providers.

#### Arbovirus Specimen Collection and Transport

##### *Acute and convalescent serum:*

Collect 7–10 ml of blood in a red-top or tiger-top collection tube. Acute phase serum should be collected on day 10 of illness, as most cases have detectable serum IgM antibody by the eighth day of illness. Convalescent serum should be collected on day 21 of illness; most infected individuals demonstrate long-lived serum IgG antibody by three weeks post infection. Any patient whose acute phase serum tests negative for IgM antibody needs to have a convalescent phase specimen submitted for testing. Specimens should be centrifuged and 1–2 ml of serum submitted at refrigerated temperature to the Vermont Department of Health Laboratory.

##### *Cerebrospinal fluid:*

Collect 1-2 ml of cerebrospinal fluid (CSF) as early as possible. IgM antibody is detectable in CSF in most (99%) patients by the onset of symptoms, but is relatively short-lived in CSF compared with serum. Detection of IgM in CSF confirms recent infection, although infection cannot be definitively ruled out if IgM is not detected. IgG antibody in CSF often does not reach detectable levels and is therefore not a sensitive indicator of infection. Specimens should be submitted frozen to the Vermont Department of Health Laboratory.

All specimens should be accompanied by a completed form VDHL's Clinical Test Request Form. Date of onset must be included

The form and serology mailers can be obtained by contacting the VDHL at (800) 660-9997, extension 7560.

## **6. Passive veterinary surveillance for arbovirus infection**

- a. Disseminate information on veterinary surveillance activities to veterinarians throughout the state. (VDH, VAAFMM)
- b. Facilitate testing of suspect veterinary cases. (VDH, VAAFMM)
- c. Maintain surveillance data on arbovirus-infected domestic animals in Vermont. (VAAFMM, VDH)
- d. Provide veterinary surveillance data to the public and local officials. (VDH, VAAFMM)
- e. Report veterinary surveillance data to the CDC via ArboNet. (VDH)
- f. Disseminate information about the WNV and EEE virus equine vaccines to veterinarians and horse owners throughout the state. (VAAFMM, VDH)

## **7. Adult mosquito surveillance** – Current funding only allows for limited and targeted surveillance. Routine trapping will be focused on EEEV-vector species.

- a. Determine likely sites for mosquito collection depending on target species. (VAAFMM)
- b. Identify mosquitoes to species and separate into pools. (VAAFMM)
- c. Test mosquito pools of appropriate species for WNV and EEE virus. (VAAFMM, VDH)
- d. Store any untested mosquito pools in the event that viral testing is later indicated. (VAAFMM)
- e. Maintain records of mosquito trap sites, the number and species of mosquitoes collected by location and date, and arbovirus test results. (VAAFMM)
- f. Provide mosquito surveillance data to the public and local officials. (VDH, VAAFMM)
- g. Report mosquito surveillance data to the CDC. (VAAFMM)
- h. Conduct enhanced mosquito surveillance in areas where virus has been detected in a human or domestic animal. (VAAFMM)

### Adult Mosquito Surveillance Methods

Monitoring mosquitoes in a consistent fashion provides information about species present and seasonal population trends among species. Adult mosquito surveillance will start in mid-June before the expected start of arbovirus season begins in July. Surveillance will end in mid-October unless extended surveillance is indicated due to warm air temperatures or evidence of virus. Ideally data from consecutive seasons would provide the most thorough baseline data, but limited funding has made consistent collection of mosquito data difficult.

A combination of carbon dioxide-baited CDC light traps, gravid traps and resting boxes will be used to collect mosquitoes. However, there will be an emphasis on the use of resting boxes to increase the numbers EEEV-competent species trapped.

Carbon dioxide-baited CDC light traps primarily collect host-seeking, non-blooded female mosquitoes. Traps will be set in the late afternoon or early evening and retrieved the following morning. Traps will be set and attended on a regular basis, as resources permit. Once productive trapping sites are located, traps will be operated consistently at the same sites, as resources permit.

The gravid trap is specifically designed to collect mosquitoes seeking oviposition sites. Following blood feeding, mosquitoes seek sheltered areas in which to rest and digest the blood meal into eggs. Once eggs have formed, the gravid female seeks a site to lay (oviposit) her eggs. Gravid traps will be set in the late afternoon or early evening and retrieved the following morning.

Resting box traps will be set out in areas conducive to surveying for the primary vector species for EEE virus, *Culiseta melanura*. Ground surveys may also be used to detect resting populations. Live fresh specimens will be collected from resting areas and used to determine population densities. Both natural (bridges, porches, culverts, vegetation) and artificial (red boxes, black boxes, nail-keg shelters) resting sites may be used for this purpose.

Global positioning system (GPS) units will be used as resources permit to map survey areas.

Areas targeted for mosquito surveillance will be selected based upon perceived risk (e.g., more densely populated areas, known flooding tendencies), habitat, geographic location and convenience.

#### Adult Mosquito Arboviral Testing

To detect EEE virus, *Culiseta melanura* and other *Culiseta* sp. will be prioritized for testing. Other suspected bridge vectors may also be tested including *Aedes* spp., *Ochlerotatus* spp. and *Coquilleltidia perturbans*.

When the goal is to detect WNV, trapping and testing will focus on *Culex* (e.g., *Cx. pipiens*, *Cx. restuans*, *Cx. salinarius*), and the suspected secondary vectors of the genus *Aedes* and *Ochlerotatus* (e.g., *japonicus*, *triseriatus*, *trivittatus*, *canadensis* and *vexans*).

Following sorting and identification of mosquito specimens, female mosquitoes of the same species from each trap will be pooled. A mosquito ‘pool’ is defined as a group of one to fifty mosquitoes of the same species that were trapped at the same location on the same night. All samples will be stored on dry ice, in the event that viral testing is later indicated. Pools will be tested using a PCR method by the Vermont Department of Health Laboratory.

8. **Larval mosquito surveillance** - Because of limited staff, larval mosquito surveillance has been limited to areas that are part of one of the three Mosquito Control Districts in the state.
  - a. Map and characterize aquatic mosquito breeding habitats. (VAAFMM)
  - b. Sample mosquito larvae utilizing standard dipping techniques. (VAAFMM)
  - c. Identify larvae to species. (VAAFMM)

- d. Maintain records of the number and species of larvae sampled by location and date. (VAAF,)

#### Larval Mosquito Surveillance Methods

Surveillance activities for immature (larvae and pupae) mosquitoes involve the mapping and characterization of aquatic habitats where mosquitoes breed. Mosquito breeding can occur anywhere where there is standing water available. Examples include tires, pails, garbage cans, plant pots, clogged rain gutters, bird baths, storm drains, unchlorinated swimming pools, and swimming pool covers. Mosquito breeding can also occur in natural water-filled areas, such as wetlands, temporarily flooded areas, or stream edges.

The standard one-pint dipper will be used for sampling (dipping) for mosquito larvae. Recommendations for successful dipping include:

- Larvae at or under the water surface are sensitive to water movement and shadows; try to minimize both.
- The dipper cup should be directed at making a quick but gentle sweep at the water surface.
- Enter the water at an angle, so that surface water begins entering the cup. Continue sweeping across the water surface until the cup is one-half to three-quarters full. Avoid filling the cup all the way, as larvae can escape before the dipper is righted and removed from the water.
- Larvae that are disturbed from the water surface will escape to deeper water, resurfacing only when air is needed. Pausing between dips or changing dipping locations will allow enough time for larvae to resurface.
- If there is vegetation in the water, try dipping where the water meets the leaves or stems.

Samples will be recorded as the number of larvae per dip on the Mosquito Breeding Site Survey Form. Larvae will be identified to species through the use of larval mosquito identification keys.

### **C. Response**

The key to reducing the risk of EEE and WNV infection is educating the public about measures they can take to protect themselves against mosquitoes. VDH will continue outreach and education efforts to the general public.

WNV has been detected sporadically in all regions of the state since surveillance began in 2000. To date, no particular area in the state appears to be of higher risk. The main response to WNV risk has been to educate all Vermonters about taking precautions to prevent mosquito bites and reducing mosquito breeding sites in their communities. It is anticipated that this strategy will continue to be appropriate in 2014.

EEE virus activity tends to be more focal and is typically centered near acidic hardwood swamps. In Vermont, most of the significant EEE virus activity has been detected near the swamps in southern Addison and northern Rutland Counties. It is anticipated, that this area will continue to be an area of higher risk for the foreseeable future. With the diagnosis of EEE in horses in Franklin County, this area is also considered to be at higher risk. In addition, results of the deer serosurvey indicated that deer from many different parts of the state are being exposed to the virus. While it is not yet understood if this has any significance for the risk of human illness, it is possible other high-risk foci will become evident in the future.

#### **Risk Assessment**

The response depends upon an assessment of the risk for human illness. A risk assessment matrix has been developed to help guide the response to EEE surveillance indicators. (Attachment 1). Since EEE virus is new to Vermont, this assessment should be considered to be a general guide and cannot be expected to provide any certainty of the degree of risk. Even if more data were available, predicting the likelihood of human illness has proven to be difficult in other states.

Mosquito surveillance provides the most useful information for risk assessment. Therefore, the EEE Response Matrix is best applied in areas where active adult mosquito surveillance is occurring. Risk will be assigned to an area based upon the prior two years of surveillance data with modifications made as results from the current year become available.

It is hard to describe with any certainty the at-risk area given a positive surveillance finding. There is some evidence that most human illness occurs in people who live within five miles of a wetland of the appropriate type. Therefore, we will designate an area of about five miles around positive mosquito pools as potentially at risk. Because we cannot say with certainty that people further away are not at risk, we will add an additional five mile area "of concern". In addition, if veterinary or human cases are detected, additional areas may be designated as at risk depending on the likely place of exposure. We will err on the side of including more of an area than less. The risk area may be adjusted to account for geographic features, such as the Green Mountains, which could affect the potential flight range of infected mosquitoes. The risk areas will be represented on a map which will be updated continually throughout the arbovirus season and posted on the VDH website.

Areas of the state that do not have any mosquito surveillance should be considered at “baseline” risk. Residents of those areas should take precautions to prevent mosquito bites and reduce mosquito breeding sites in their communities. The risk for WNV infection is statewide. The extent of the risk for EEE virus infection is presently unknown.

In most cases, the response will be educational and include information on preventing mosquito bites, reducing peridomestic exposure, seeking appropriate medical care and protecting susceptible animals. Increased surveillance may also be recommended. Vector management to suppress mosquito populations may be considered if the risk of human infection appears to be high.

### Response

In general, response to detection of arboviral activity will include the following:

1. Notification and communication in response to detection of WNV or EEE
  - a. First positive indicator: A press release will be issued in response to the first positive indicator.
  - b. Positive mosquito: Whenever virus is detected in a mosquito pool in a town, at a minimum, the VDH District Office and the Town Health Officer will be notified. This can be an opportunity for the dissemination of information about prevention measures. Additional press releases will be done if there is an increased risk to human and animal health. The risk depends on such factors as the species of mosquito found to be positive (ie. bird biter vs. mammal biter), the infection rate and the overall number of positive surveillance indicators.
  - c. Positive domestic animal finding: The State Veterinarian will be notified, who will in turn notify the attending veterinarian. After those notifications have been done, the Town Health Officer and the District Office will also be notified. The Communications Offices of both VDH and VAAFMM will be notified.

Active surveillance for additional veterinary cases may be considered.  
Enhanced mosquito surveillance in the area of likely exposure will also be considered.
  - d. Positive human case: The Commissioner of Health will be notified, followed by the Communications offices of VDH and VAAFMM. The District Office will be notified. To preserve patient confidentiality, the town of residence of the patient may need to be withheld, in which case town officials where the patient lives will not be specifically notified.

A press release will be considered.  
Enhanced mosquito surveillance will be considered.  
Enhanced passive or active human surveillance will be considered. In most cases, a reminder for physicians to consider arboviral illness will be sent out using VT-HAN.

### 2. Vector Management

Larval source reduction in defined areas is the most effective way to prevent transmission of WNV. The efficacy of larviciding to prevent EEE is less clear. Adulthood may be indicated if large numbers of infected adult mosquitoes are present. Individual situations will be evaluated, and the appropriate suppression method used. If adulthood is indicated, then the State will follow the Aerial Adulthood Application in Response to Mosquito-Borne Disease Threat: Multi-Agency Response Flowchart (Attachment 2) and do the following

- a. Consult with local officials regarding proceeding with a suppression project. (VDH, VAAF)
- b. Assist local officials in conducting informational meetings on proposed mosquito suppression programs. Make public notice at least 24 hours prior to any state-ordered ground-level or aerial spraying of adulthood. (VDH, VAAF)
- c. Secure all permits necessary to conduct the appropriate mosquito suppression program. (VAAF)
- d. Notify the State Apiculturist of adulthood. State Apiculturist will notify beekeepers in the area, directly or indirectly and to the extent possible based on available contact information for those constituents. (VAAF)
- e. Notify the Vermont chapter of the Northeast Organic Farming Association of Vermont. (VAAF)
- f. Notify local healthcare providers and the poison control center. (VDH)
- g. Notify the Commissioner of the Vermont Department of Fish and Wildlife (VAAF)
- h. Notify veterinarians and livestock owners and producers using notification channels such as the Vermont Veterinary Medical Association, the Animal Agricultural Alert Network and pertinent email distribution lists. (VAAF)
- i. Secure pesticide(s), aerial applicator, and ground-based ULV machinery and enlist certified pesticide applicators to conduct suppression programs. (VAAF)
- j. Assemble a ground monitoring crew to deal with environmental issues (e.g., weather, water, wildlife, livestock, non-target and ecosystem effects, organic farms and other crop lands). (VAAF)
- k. Apply mosquito larvicide or adulthood. (VAAF)
- l. Implement surveillance for possible health effects of exposure to pesticides. Data will be collected on reports to the poison control center and local emergency departments of possible health effects of pesticide exposure. This information will be used to identify:
  - 1) Serious, unusual, or repeated acute health effects that show a pattern of association with local or aerial spraying that might warrant further evaluation. More intensive evaluation might include collection of detailed case histories for a subset of reports, or review of emergency department

records.

- 2) Unexpected routes of exposure that might warrant investigation.
- 3) Frequent problems in responding to concerns and inquiries about pesticide health effects, including knowledge gaps.

# Attachment 1:

## EEE Estimated Risk Assessment and Response Matrix

Risk Category	Definition of risk category	Recommended response	State Response	Local Response
Baseline/No mosquito surveillance	<p>Prior 2 years: No human or veterinary cases reported.</p> <p>Current year: No mosquito surveillance available in this region AND No human or veterinary cases reported</p>	<p>1) General precautions to prevent mosquito bites:</p> <ul style="list-style-type: none"> <li>a) Use mosquito repellents</li> <li>b) Wear long sleeves and long pants</li> <li>c) Repair screens</li> <li>d) Remove standing water</li> </ul> <p>2) State agencies/town officials:</p> <ul style="list-style-type: none"> <li>a) Disseminate information about personal protection and source reduction</li> <li>b) Conduct routine human and veterinary surveillance</li> <li>c) Above activities should occur statewide</li> </ul>	<p>State creates prevention messages for distribution to the public statewide.</p> <ul style="list-style-type: none"> <li>• VAAFM will create animal health messages</li> <li>• VDH will create human health messages.</li> </ul> <p>State (VAAFM and VDH) will distribute public health messages in various ways including emails to town officials, emails to VDH District offices; as part of annual summer camp package; emails to other state agencies (ie FPR, VFW)</p> <p>State (VAAFM and VDH) will create press release with prevention messages.</p>	<p>Town officials help distribute the message. Distribution efforts may include posting flyers in public places; posting information on the town website; posting information on public forum websites, such as Front Porch Forum.</p>

# Attachment 1:

## EEE Estimated Risk Assessment and Response Matrix

<p>Low</p>	<p>Prior 2 years: EEE virus detected in mosquitoes</p> <p>OR</p> <p>Current year: EEE virus detected in mosquitoes at a single trapping site</p> <p>AND</p> <p>No human or veterinary cases</p>	<p>1) State agencies/town officials:</p> <p>a) Target public education efforts about risk potential, personal protection and source reduction to the at-risk communities*</p> <p>b) If indicated by entomological data, use larvicides to target vector species. If appropriate, consider source reduction techniques.</p> <p>c) If current year activity includes EEE virus isolates, may consider adulticiding† based on current regional epidemiology and surveillance efforts.</p> <p>d) Supplemental trapping and testing of mosquitoes near the positive findings may be considered.</p>	<p>Incorporates “Baseline” response AND</p> <p>State creates prevention messages for distribution to the public in the at-risk community</p> <ul style="list-style-type: none"> <li>• VAAFM will create animal health messages</li> <li>• VDH will create human health messages.</li> </ul> <p>State (VAAFM) continues adult mosquito surveillance; considers whether expansion of mosquito surveillance is needed.</p>	<p>Incorporates “Baseline” response AND</p> <p>Town officials in targeted communities disseminate educational messages.</p> <p>Town/local mosquito control district continues larval surveillance and control; increase source reduction if needed; continue existing adulticiding program; consider applying adulticide around area of positive trap site if location is close to population center</p>
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\* For the purposes of this risk assessment, at-risk communities will include the area within 5 miles of a wetland where EEE virus was found in mosquitoes. In addition, because the risk may not be limited to a 5 mile radius, an additional zone of caution will be designated which includes the area between 5 and 10 miles from the wetland. Areas designated to be at-risk or of caution may be modified if geography would likely mitigate the risk. For example, the risk would not reasonably be expected to extend over the Green Mountains to the communities on the other side.

† The decision to initiate adult mosquito control will depend in part on the time of year, the mosquito population abundance, and the proximity of virus activity to at-risk populations. The ability to respond by ground spraying instead of aerial spraying depends upon the availability of a close network of roads. In many communities in Vermont, the density of roads may be insufficient for ground-based application of adulticide to be effective at reducing human risk for illness. To maximize effectiveness, adulticide treatment should consist of two applications within 7 days of each other.

# Attachment 1:

## EEE Estimated Risk Assessment and Response Matrix

<p>Moderate</p>	<p>Prior 2 years: Confirmation of human and/or veterinary case</p> <p>OR</p> <p>Sustained viral activity in mosquitoes</p> <p>OR</p> <p>Current year: No animal or human cases in current year</p> <p>AND</p> <p>Sustained EEE virus isolations from mosquitoes at one location <i>or</i> multiple locations within a community <i>or</i> EEE virus isolated from bridge vectors</p> <p>Definition: <b>Sustained:</b> when mosquito activity is detected for 2 or more weeks within one focal area</p>	<p>Incorporates previous category response AND</p> <p>1) State agencies/town officials:</p> <p>a) If indicated by entomological data, increase larval control, source reduction and public education emphasizing personal protection measures</p> <p>b) Consider targeted larviciding, and if current year activity, consider adulticiding targeted at likely vector species.</p> <p>c) Consider reaching out to high-risk populations (LTCF, schools, camps) and educating them on personal protection measures.</p>	<p>Incorporates previous category response AND</p> <p>State (VDH) creates prevention messages for high-risk populations and disseminates the information, via District Offices, to institutions in the target area that service at-risk populations.</p> <p>If current year activity is detected, State (VDH and VAAF) and Town officials should discuss whether application of adulticide is necessary to protect public health and determine the extent and best method of treatment.</p> <p>If application of adulticide is deemed necessary, the State (VAAF) will make the determination of which pesticide to use and hire the contractor who will apply the adulticide.</p> <p>If application of adulticide is deemed necessary, the State (VDH and VAAF) will alert the public as to the date and times of application and any recommended precautions that should be taken.</p> <p>State (VDH) considers declaration of a public health risk.</p>	<p>Incorporates previous category response AND</p> <p>Town/Local mosquito control district considers intensifying larviciding for secondary vector species if appropriate; and consider intensifying ground application of adulticide</p> <p>Town officials continue to disseminate educational messages in targeted communities.</p> <p>Town officials should confer with State on necessity of applying adulticide.</p> <p>If application of adulticide is deemed necessary, town officials should work with the State to alert their residents about the date and time of application.</p>
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# Attachment 1:

## EEE Estimated Risk Assessment and Response Matrix

<p>High</p>	<p>Current year: A single confirmed human or veterinary case OR Sustained or increasing viral activity in mosquitoes in the community</p>	<p>Incorporates previous category response AND</p> <ol style="list-style-type: none"> <li>1) General public:             <ol style="list-style-type: none"> <li>a) Avoid areas where mosquitoes are very active.</li> <li>b) Adjust outdoor activity to avoid peak mosquito hours (from dusk until dawn)</li> </ol> </li> <li>2) State agencies/town officials:             <ol style="list-style-type: none"> <li>a) Intensify public education efforts about personal protection using multimedia messaging.</li> <li>b) Actively seek out high-risk populations (LTCF, schools) and educate them on personal protection.</li> <li>c) Initiate trapping and testing of vector species, if not already being done, in the likely exposure area of any human or veterinary case</li> <li>d) Consider intensifying larviciding and/or adulticiding control measures as indicated by surveillance</li> <li>e) VDH will confer with VAAFM entomologists to determine if the risk of disease transmission threatens to cause human cases. If the risk appears to be ongoing or increasing, intensified ground based or targeted aerial adulticiding may be recommended.</li> </ol> </li> </ol>	<p>Incorporates previous category response AND</p> <p>State (VDH) creates and disseminates prevention messages, including the recommendation to curtail outdoor activities from dusk to dawn.</p> <p>State (VAAFM) considers adding mosquito traps around positive indicators if traps are not already present.</p> <p>State (VDH and VAAFM) will determine if aerial spraying is warranted to protect public health and the extent of aerial spraying that is needed.</p> <p>If application of adulticide is deemed necessary, the State (VAAFM) will make the determination of which pesticide to use and hire the contractor to apply the adulticide.</p> <p>State (VDH) considers declaration of a public health risk, if not already declared.</p>	<p>Incorporates previous category response AND</p> <p>Town officials should work with institutions in community to decide whether evening activities should be curtailed.</p> <p>Town officials continue to disseminate educational messages in targeted communities.</p> <p>Town/Local mosquito control district should consider intensifying ground-based adulticide application around positive indicators and nearby population centers.</p> <p>If application of adulticide is deemed necessary, town officials will work with the State to alert their residents about the date and time of application.</p>
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## **Aerial Adulticide Application in Response to Mosquito-Borne Disease Threat: Multi-Agency Response Flowchart**

### **1. Determination of Response**

When human risk is elevated to a high level of concern as indicated by the VT Arbovirus Surveillance and Response Plan; VDH will determine, in consultation with VAAFM, whether aerial application is warranted.

### **2. Characterization of Area of Risk**

Once consensus is obtained, VDH and VAAFM characterize the area of risk and delineate the perimeter of the spray area based on mosquito and virus surveillance.

### **3. Commissioner Certification**

The Commissioner of Public Health will issue a “Determination of Significant Public Health Risk Requiring Aerial Application of Pesticide to Protect Public Health”

***Action Items 4a-4c Occur Simultaneously:***

#### **4a. Determination of Appropriate Pesticide**

VAAFM will consult with the Vermont Pesticide Advisory Committee (VPAC) to determine the pesticide to be used in the event that an aerial application is necessary. In the event that aerial application is warranted, VAAFM will confirm this selected pesticide for use.

#### **4b. Determination of No-Spray Zones**

Aerial no-spray zones (mosquito treatment sensitive areas data layers) defined:

- 1) Certified organic farms
- 2) Surface water supply resource areas
- 3) Commercial fish hatcheries/aquaculture

VAAFM/VDH will submit a ‘Notice of Intent’ to the Vermont Department of Environmental Conservation to obtain NPDES PGP (National Pollutant Discharge Elimination System pesticide general permit) coverage within 10 days of the aerial adulticide application, if there is no current valid permit.

#### **4c. Exclusion/Inclusion of Priority Habitats**

VDH will determine, in consultation with VAAFM, if spraying in mosquito treatment sensitive areas is necessary to protect the public health.

If spraying in these areas is necessary to reduce the risk to public health then:

VDH requests ANR to issue a permit to VAAFM for taking endangered, threatened, or special concern species.

### **5. Preparation of Final GIS Data**

VAAFM coordinates compilation of mosquito treatment sensitive areas within designated VDH spray areas, using data layers (no-spray zones) developed by VAAFM and the Northeast Organic Farming Association, onto a final map.

### **7. Emergency Room and Poison Control Contacts**

VDH contacts and provides pesticide illness surveillance protocols to emergency departments, poison control centers, and District Offices.

### **8. Notification of Date & Time of Application**

VAAFM and VDH will publicize the locations, dates, and times of aerial spraying.

VAAFM will post a map of the aerial spray area to a website and will update this site

Attachment 2:

during spray operations.

VDH will provide telephone numbers for the public for information about the spray zone, any recommended precautionary measures and other questions.

**9. Operational Procedures-Aerial Application**

VAAFM insures that licensed and experienced contractors are used and that the aerial application operational procedures are in compliance with Vermont Aviation and FAA guidelines and standards.

VDH: Vermont Department of Health

VAAFM: Vermont Agency of Agriculture, Food and Markets

ANR: Vermont Agency of Natural Resources