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Memorandum

TO: Community

FROM: Todd I. Selig, Administrator

DATE: Spring 2011

RE: Reducing the Risk to Durham Residents for Contraction of West Nile Virus and Eastern Equine Encephalitis (EEE) During The 2011 Mosquito Season

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The State of New Hampshire saw a growth in activity in both West Nile Virus and Eastern Equine Encephalitis (EEE) during the 2005 mosquito season. Despite an aggressive state-wide education campaign, seven NH residents developed serious illness following infection with EEE, two of whom died. Once present in an environment, both viruses will likely continue to surface to some extent every year. This memorandum provides information concerning West Nile Virus and Eastern Equine Encephalitis, prevention and control strategies, and the Town Administrator's planned response in 2011.

Eastern Equine Encephalitis (EEE)

EEE virus is an alphavirus, enzootic in many passerine bird species (perching song birds) found in fresh-water swamp habitats. The virus is transmitted among wild birds in these areas primarily by Culiseta melanura, a mosquito that feeds almost exclusively on birds. EEE virus has a cycle of natural infection among bird populations with occasional incidental infections of humans, non-human mammals (most often horses), and large domestic birds (emus, ostriches, etc.). Infected mammals do not serve to spread the virus since mosquitoes biting infecting mammals do not become infected. *Risk of infection in humans is a function of exposure to infectious human-biting mosquitoes.* These "bridge vectors" (i.e., a mosquito species that is indiscriminant and will feed on birds or humans) are responsible for transferring the EEE virus to humans.

Most people infected with EEE will not have symptoms of disease, while others may get only a mild flu-like illness with fever and headache. However, for people with infection of the central nervous system, a sudden high fever, severe headache, and stiff neck can be

followed quickly by seizures, coma, and death. Human cases of EEE occur sporadically in the United States. Historically, clusters of human cases have occurred in sequential cycles of two to three years, with a hiatus of numerous years between outbreak and high-risk years. Between 1964 and 2000, 182 human cases of EEE were reported in the United States, with an average of 5 cases per year. These cases were all reported from eastern states, with most of the cases occurring in Florida (53 cases), Georgia (22 cases), Massachusetts (21 cases), and New Jersey (17 cases).

Prior to 2004, the most recent EEE activity documented in New Hampshire was several equine cases in 1982. In 2004, 3 emus, 3 horses, 19 mosquito pools, and one human EEE case were reported. In 2005, 7 human cases were reported resulting in 2 deaths. Also in 2005, 54 birds (including 2 emus), 9 horses, 4 alpacas, 1 llama, and 15 mosquito pools all tested positive for EEE.

The incidence of EEE infection in humans varies by geographic area. Human EEE disease is more common in areas that support dense populations of passerine birds and have favorable breeding conditions for the enzootic mosquito vector. In New Hampshire, these areas consist mainly of large and mature white cedar and red maple swamps. The majority of EEE human cases in New Hampshire have occurred in Rockingham County with cases also occurring in Merrimack and Hillsborough counties.

The other major factors that affect the risk of human EEE infection are the abundance of specific species of mosquitoes at critical periods during the transmission season, in part determined by groundwater levels, the timing of rainfall during the mosquito season, and the likelihood of mosquito exposure. The use of personal protective measures (avoidance of mosquitoes, use of repellant) by people reduces their risk of exposure and infection. *Children and the elderly are at highest risk of EEE.*

West Nile Virus (WNV)

West Nile Virus (WNV) is a flavivirus. Similar to EEE, WNV is also maintained in the environment in an enzootic cycle that involves birds, with indiscriminant feeding mosquitoes infecting humans and other mammals. WNV is known to result in the death of certain species of birds, especially corvids (i.e., American crows, blue jays). The high mortality of WNV infections in birds provides sentinel information for possible risk of human WNV infections. WNV causes sporadic disease in humans, and occasionally results in significant outbreaks. More than 2600 human cases of WNV neuroinvasive disease (West Nile meningitis and West Nile encephalitis) and WNV fever were reported nationwide to the Centers for Disease Control and Prevention in 2005.

WNV was first identified in New Hampshire in August of 2000 in an infected dead crow. By the end of the 2000 season, 7 positive birds were reported. During the 2001 season, 83 positive birds (from the southeast portion of the state), 3 mosquito pools (from Salem to Dover), and 2 horses (from Newton and Kingston) were reported. Surveillance for the 2002 season detected WNV in 119 birds and 33 mosquito pools. The distribution of birds and mosquitoes was again in the southern half of the state. The 2003 season resulted in

213 birds testing positive, as well as 6 mosquito pools, 1 horse, and 3 humans. During the 2004 season, 14 birds tested positive. During the 2005 season, 46 birds and 1 mosquito pool tested positive for WNV.

WNV affects the central nervous system. While symptoms may vary, about one in 150 people infected with WNV will develop severe illness (WNV neuroinvasive disease). Severe symptoms can include high fever, headache, neck stiffness, disorientation, coma, tremors, convulsions, muscle weakness, vision loss, and paralysis. These symptoms may last several weeks, and neurological effects may be permanent. Up to 20 percent of the people who become infected will display symptoms of WNV fever, including fever, headache, body aches, and sometimes swollen lymph glands. Symptoms can last for days to months. People over 50 years of age are at a higher risk of developing serious symptoms of WNV.

West Nile virus activity varies year to year. When there are both a large number of infected birds and a high proportion of infected mosquitoes in a relatively small geographic area, the risk of transmission of virus to humans will increase.

Prevention and Control

The key to reducing or eliminating the incidence of arboviral disease is education and outreach to the public regarding the need for prevention and explaining how they can protect themselves from diseases such as EEE and WNV. Like much of the work in public health, it is difficult to quantify exactly how effective these prevention efforts are or will be. For example, with a rare and cyclical disease such as EEE, it would be impossible to identify the number of cases that were avoided in the 2005 - 2010 seasons as a result of an aggressive and sustained public education campaign by the N.H. Department of Health and Human Services and its state and local partners like the Town of Durham.

The emergent public health threat posed by arbovirus illness requires a vigilant outreach effort. Individuals can take a number of simple steps that will greatly reduce the risk of mosquito-borne viruses to them, their families, and their communities. Choosing to wear protective clothing (e.g., long pants, long-sleeve shirts), using mosquito repellants, and minimizing opportunities for certain mosquitoes to breed are all important ways individuals can help prevent the spread of WNV and EEE in Durham.

What can residents do around their homes to help reduce exposure to mosquitoes?

- 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 the United States.
- Do not allow water-holding containers. 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 cannot deposit eggs in or on 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 breeding grounds 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. Mosquito larvae look like tiny shrimp and are not recognized for what they really are by most people.
- Remind or help neighbors to eliminate breeding sites on their properties.

What can residents do to reduce their risk of becoming infected with WNV or EEE?

When mosquitoes are active, take the following precautions:

- Wear protective clothing such as long pants, long-sleeved shirts, and socks if outside during evening, nighttime, and dawn hours, the time when mosquitoes are most active, and at other times when mosquitoes are biting.
- If outside during evening, nighttime, and dawn hours, or whenever mosquitoes are biting, consider the use of an effective insect repellant.
- Vitamin B, ultrasonic devices, incense, and bug zappers **have not** been shown to be effective in preventing mosquito bites.
- Use repellants according to manufacturer's directions.
    - Repellents containing DEET have been proven effective. No more than 30% DEET should be used on adults or children.
    - The American Academy of Pediatrics (AAP) has updated recommendations 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 repellants with DEET should not be used on infants less than 2 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 or 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.
- Research has shown that repellents based on natural oils or herbs are less effective than products based on Picaridin or DEET.
- Vitamin B, ultrasonic devices, incense, and bug zappers have not been shown to be effective in preventing mosquito bites.

Spraying Mosquito Larvae

Spraying to kill mosquito larvae can be very effective, and has minimal environmental or toxicological risk if the biological agent Bti is used. Bti is shorthand for *Bacillus thuringiensis* variety *israelensis*, a natural bacterium that kills certain fly larvae, but not other organisms. Bti kills mosquito larva (or black fly larvae if used in streams), but does not harm fish, mammals, amphibians, reptiles, or other insects. The mosquito larvae must feed on the Bti particles. Mosquitoes in their pupal or adult stages will not be killed by Bti.

Using Bti has several major drawbacks: 1) It must be done before EEE or WNV cases appear – beginning in April/May before we really know what the risk is going to be during the mosquito season; 2) It usually takes more than one treatment to control mosquito larvae for a long time; 3) Treating water with pesticides in New Hampshire requires a special permit from the Pesticide Control Division of the State Department of Agriculture. Getting a permit takes time and effort. (Durham has again applied for such a permit and possessed one in each of the last five years.)

There are chemical-based larval control materials other than Bti, but these chemicals should be avoided as they kill many other organisms besides mosquito larvae.

Communities should tie a spraying program to a monitoring program that identifies where and when the human-biting or WNV/EEE-transmitting species are abundant. Spraying mosquitoes that are not involved in the disease transmission wastes time and money. Monitoring is expensive and requires special training that few New Hampshire pesticide applicators possess.

Source reduction is difficult. If we experience rainy conditions this season, rainwater will fill countless thousands of vernal pools, marshes, tree holes, and empty containers left outdoors. Because adult female mosquitoes lay hundreds of eggs apiece, the mosquito population can explode during rainy seasons. In seasons with very little rain, the swamps, marshes, and containers dry up, reducing breeding sites and the subsequent number of adult mosquitoes.

Spraying Adult Mosquitoes

Spraying mosquitoes may help reduce the risk of being bitten, but presents a number of problems: 1) The vast majority of New Hampshire's 47 species of mosquitoes are not carriers of either WNV or EEE; 2) Using chemical insecticides can carry environmental and toxicological risks; 3) Sampling and identifying larval or adult mosquitoes is time intensive and expensive; 4) Spraying to kill adult mosquitoes is difficult or impossible in many areas; 5) The effect of spraying for adult mosquitoes lasts only a few hours; 6) Mosquitoes can fly long distances (1 mile) so they quickly re-invade the sprayed area from outside; 7) The impact of chemical insecticide application is not specific to mosquitoes.

Introducing Predators

Although putting up houses for birds or bats theoretically might help, these techniques have never been demonstrated to reduce mosquito numbers. Bats and insectivorous birds eat whatever insects are abundant and the correct size for them. Since catching insects in flight takes a lot of energy, they optimize feeding by going for bigger bites rather than staying with tidbits (mosquitoes). Also, predators do not knock down the mosquito population far enough to help humans.

Introducing dragonfly larvae may theoretically help, but any New Hampshire water body appropriate for dragonflies is already inhabited by an abundance of dragonfly species. The same is already true for other mosquito larvae predators. It is not necessary to import predators because they are already present. In addition, the dragonfly species appropriate for a particular body of water varies from site to site. We have roughly 100 species of dragonflies in southern New Hampshire. Nearly all dragonfly species are daytime flyers while very few mosquitoes are daytime fliers.

Dragonflies are among predators that would be killed through the use chemical insecticides.

Planned Response for 2011

In each of the last several years, the Town of Durham has worked with Municipal Pest Management Services, Inc. to apply for and obtain a special permit from the Pesticide Control Division of the State Department of Agriculture to implement a mosquito larvae spray and adult spray program, if needed, over the course of the mosquito season. The Town has historically budgeted a total of $500 for permit and control activities and

specifically notes in the operational budget that if additional funds are needed associated with the presence of EEE or WNV in the area, these monies would be drawn from the Town's contingency fund totaling $100,000 in FY 2011.

Since 2002, the Town has proactively launched a public education campaign stressing the points made in the this memorandum concerning what citizens can do to reduce their risk of being infected with WNV and EEE, as well as what can be done around residents' homes to reduce the risk of mosquito activity.

Due to the presence of 7 human cases of EEE in New Hampshire in 2005, including 2 deaths, and as a result of positive bird tests for WNV in the immediate area, the Town Administrator, in consultation with the New Hampshire Department of Health and Human Services, the University of New Hampshire, and the Oyster River Cooperative School District, authorized the Town's state-approved municipal pest management consultant to begin narrowly focused and limited adult mosquito spraying in response to community concern about the West Nile Virus and EEE confirmed threat. The Town of Durham undertook limited perimeter ground spraying at the following locations beginning in late-September: **Oyster River High School, Oyster River Middle School, Wagon Hill Farm, Woodridge Road Park and Jackson Landing Park.** This spraying activity was done manually, not by an airplane or truck-mounted fogging system, to minimize environmental impacts. Mosquito precautions that had been stressed all summer by state agencies and the Town of Durham were stressed anew. UNH also undertook limited perimeter spraying of athletic fields in that year in conjunction with Durham's efforts at its own expense. The Town undertook targeted perimeter spraying in 2006 as well, but in 2007 - 2010 perimeter spraying was not necessary due to the relatively small number of positive WNV/EEE tests within identified dead birds found across the state.

Unless directed otherwise by the Town Council, the Town Administrator plans to once again move forward with a strategy in 2011 focusing upon education and outreach to the public regarding the need for prevention and explaining how members of the community can protect themselves from diseases such as EEE and WNV. Only in the case of documented WNV or EEE activity in the immediate area would the Administrator contemplate additional targeted measures similar to those undertaken in 2005 and 2006.

Acknowledgements

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