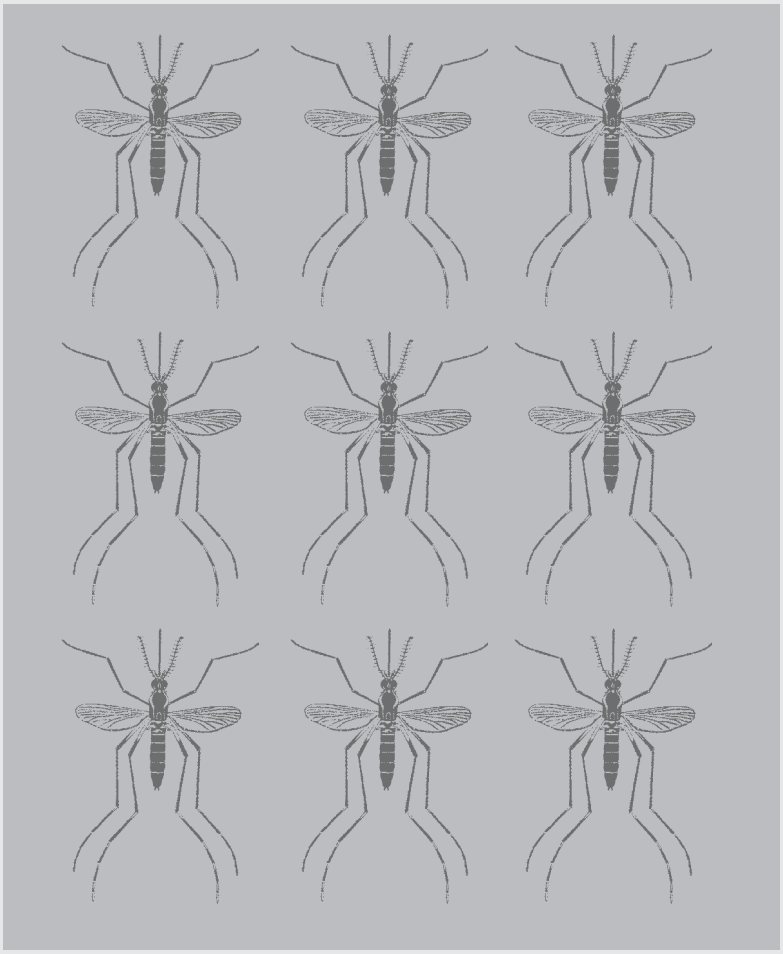
WEST NILE ENCEPHALITIS:
What you need to know



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College of Agricultural Sciences
Agricultural Research and Cooperative Extension

Introduction

Q. What is the West Nile virus?

A. The West Nile virus, which can cause encephalitis, is a mosquito-transmitted virus that is commonly found in humans and birds and other vertebrates in Africa, Eastern Europe, West Asia, and the Middle East, but had not previously been documented in the Western Hemisphere before August 1999.

Q. Where did the West Nile virus that was first detected in the New York City area come from?

A. It is not known where the United States virus originated, but it is most closely related genetically to strains found in the Middle East.

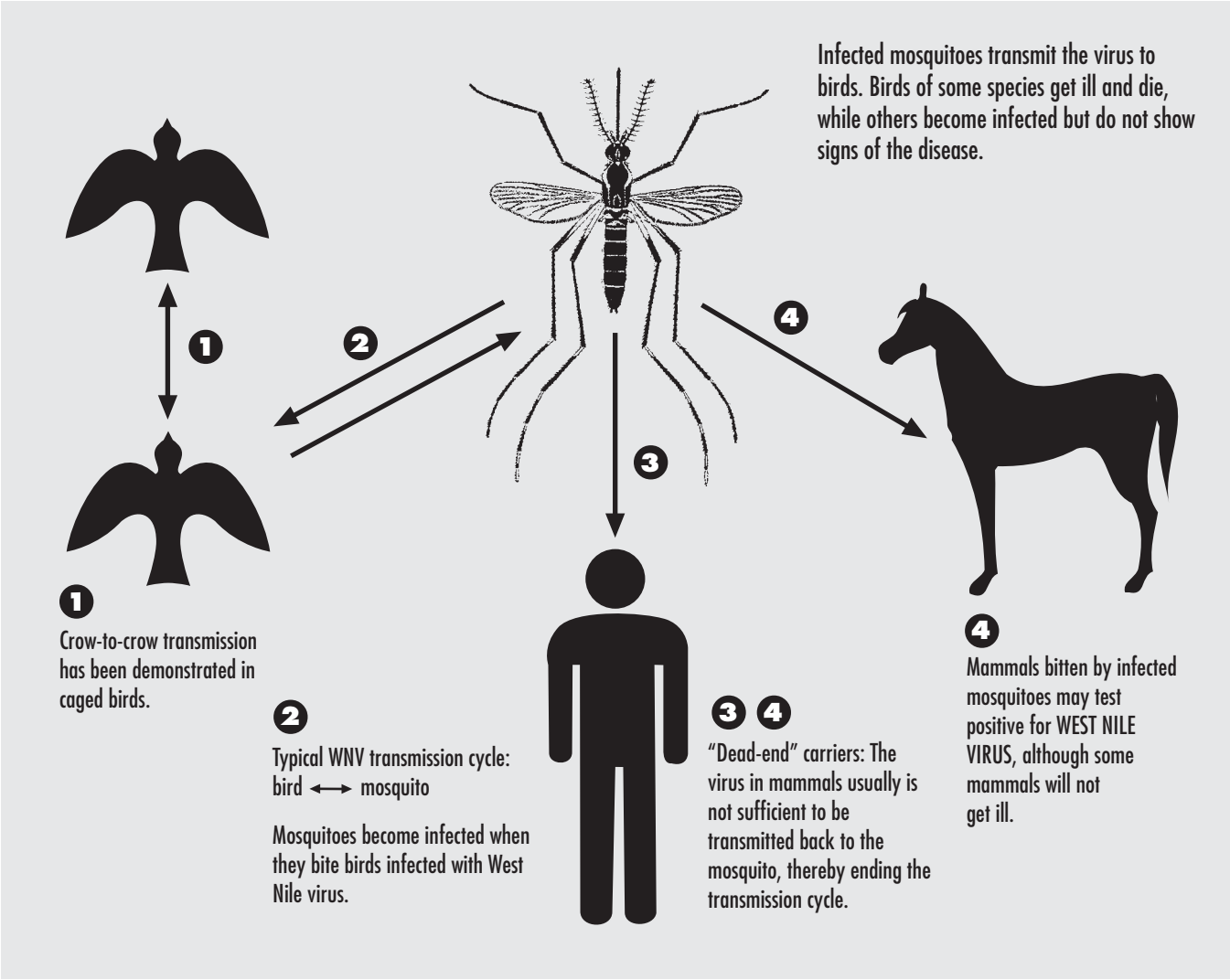
Q. How did the West Nile virus get into the United States?

A. The most likely explanation is that the virus was introduced by an infected mosquito or bird.

Q. How long has the West Nile virus been in the United States?

A. It is not known how long the virus has been in the United States, but scientists at the Centers for Disease Control and Prevention (CDC) believe the virus has probably been in the eastern United States since the early summer of 1999.

Basic Transmission Cycle of the West Nile Virus



Transmitting West Nile virus

Q. What is the basic transmission cycle?

A. Mosquitoes become infected when they take a blood meal from an infected bird. The virus circulates and multiplies in the mosquito's blood for several days. The virus then penetrates the mosquito's salivary glands. After an incubation period of 10 to 14 days, the infected mosquito can transmit West Nile virus to humans and animals while taking its next blood meal. During the feeding, the saliva and virus are injected into the animal or human, where it multiplies and may cause illness.

Q. Can you get the West Nile virus from another person?

A. No. The West Nile virus is not transmitted from person to person. You cannot get West Nile virus from touching, kissing, or caring for a person who has the disease, or from a health care worker who has treated someone with the disease.

Q. Can you get the West Nile virus directly from birds?

A. There is no evidence that a person can get the virus from handling live or dead infected birds. However, avoid bare-handed contact when handling dead animals, including dead birds. Use gloves or double plastic bags to place the carcass in a garbage can.

Q. Can you get West Nile virus from ticks or insects other than mosquitoes?

A. Infected mosquitoes are the primary source for West Nile virus transmission. Ticks infected with West Nile virus have been found in Asia and Africa. Their role in the transmission and maintenance of the virus is uncertain.

Health Information about West Nile Encephalitis

Q. What is "encephalitis?"

A. "Encephalitis" is an inflammation of the brain that can be caused by head injury, bacterial infections, or most commonly, viral infections.

Q. What are the symptoms of West Nile encephalitis?

A. Most people who are infected with the West Nile virus either have no symptoms or experience mild illness such as fever, headache, and body aches before fully recovering. Some people also may develop a mild skin rash or swollen lymph glands. A more severe infection may be marked by headache, high fever, a stiff neck, stupor, disorientation, coma, tremors, convulsions, muscle weakness, paralysis, and, occasionally, death.

Q. What is the incubation period in humans for West Nile encephalitis?

A. The incubation period of a West Nile virus infection is usually 3 to 15 days.

Q. How is West Nile encephalitis treated?

A. There is no specific treatment, medication, or cure, but the symptoms and complications of the disease can be treated. More severe cases may require intensive supportive therapy, such as hospitalization, intravenous (IV) fluids, airway management, ventilatory support, and prevention of secondary infections, such as pneumonia.

Q. Is there a vaccine for humans against West Nile encephalitis?

A. No. However, research is currently being done to develop a vaccine for humans.

Q. Who is at risk of developing West Nile encephalitis?

A. All residents of areas where virus activity has been identified are at risk of getting West Nile encephalitis. People over 50 years of age have the highest risk of severe illness.

Q. Is the disease seasonal in its occurrence?

A. In temperate climates, West Nile encephalitis cases occur primarily in hot weather during the late summer or early fall. The risk for infection ends when sustained freezing temperatures occur and mosquito activity ceases for the season. In warmer climates, where mosquitoes are active all year, the West Nile virus can be transmitted year-round.

Q. What should be done if you think you have West Nile encephalitis?

A. See a doctor immediately if you develop symptoms such as high fever, confusion, muscle weakness, and severe headaches. Patients with mild symptoms should recover completely and do not require specific medication or laboratory testing.

Q. In 2002, what other means of West Nile virus transmission—other than mosquitoes—occurred?

A. The CDC has confirmed West Nile virus transmission through transplanted organs and through blood products. There is documentation of transplacental (mother-to-child) transmission of West Nile virus in humans. West Nile virus may also be transmitted from a nursing mother to her infant through breast milk. Finally, two lab workers were infected—one from a needle stick while handling live virus and the other from a scalpel injury while handling an infected dead bird.

Q. What are the risks of these other transmission methods?

A. Although persons needing blood transfusions or organ transplants need to be aware of the risk for West Nile virus infection, the benefits of receiving needed transfusions or transplants greatly outweigh the potential risk for West Nile virus infection. Also, the above-mentioned transmission incidents represent a very small proportion of the total number of West Nile virus human cases. For this reason, more research will be needed to determine the risks of West Nile virus transmission through transplanted organs, blood products, and pregnancy. Remember, the vast majority of West Nile virus infection in humans occurs through the bite of a West Nile virus-infected mosquito.

Spread of the West Nile Virus

Q. Where was the West Nile virus first detected in the United States?

A. The 1999 outbreak of West Nile virus occurred primarily in the New York City metropolitan area.

Q. How did the West Nile virus spread across the United States?

A. The West Nile virus spread across the United States in just 4 years. In 1999, the West Nile virus was detected in four states: New York, New Jersey, Connecticut, and Maryland; in 2000, West Nile virus was in 12 Northeast and Mid-Atlantic states (including Pennsylvania) and Washington, D.C.; in 2001, West Nile virus was in 27 states and included states in the Southeast and Midwest; and by 2002, West Nile virus was detected in 44 states and had reached the West Coast.

Q. Where and how many human cases of West Nile encephalitis have occurred in the United States?

A. In 1999, 62 humans had positive West Nile virus detections (7 deaths), all from New York State; in 2000, New York, Connecticut, and New Jersey had a total of 20 human detections (2 deaths); and in 2001, those three states and Pennsylvania, Maryland, Massachusetts, Georgia, Florida, Alabama, and Louisiana reported 64 human detections (9 deaths). By 2002, 3,873 West Nile virus detections in humans had been reported in 39 states (246 deaths); Pennsylvania had 60 West Nile virus positive human cases (8 deaths).

If I Am Bitten by a Mosquito, Will I Develop West Nile Encephalitis?

Q. If I live in an area where birds or mosquitoes with the West Nile virus have been reported, and I am bitten by a mosquito, am I likely to get sick?

A. No. Even in areas where mosquitoes do carry the virus, very few mosquitoes are infected. The chances that any one bite will be from an infected mosquito are very small. In addition, only a small number of people who become infected with the West Nile virus from a mosquito bite will develop a serious case of encephalitis.

Q. Has the general population been tested for the West Nile virus?

A. Yes. A serosurvey, in which participants complete an interview and provide a sample of their blood for

testing, was done in Queens, New York, in 1999. The results indicated that approximately 2.6 percent of the people age five and older were infected with West Nile virus, but either had no symptoms or experienced mild illness. These results cannot be applied to other areas of the Northeast. Since the epicenter had the highest rate of West Nile encephalitis cases, researchers believe that the infection rates elsewhere in the city were significantly lower. In 2000, serosurveys were conducted in Staten Island and Suffolk County in New York, and in Fairfield County, Connecticut. However, the infection rates were much lower, ranging from 0.0 percent to 0.5 percent.

Q. Are people who tested positive still at risk from West Nile virus?

A. No. The infection, and any associated illness, is short-lived. A person with antibodies to the West Nile virus will probably have lifelong immunity to a repeated infection with this virus.

Effects of the West Nile Virus on Animals

Q. Do wild birds infected with the West Nile virus die or become ill?

A. Although this has not been previously reported in nature, beginning with the 1999 New York epidemic more than 20 exotic birds died at the Bronx Zoo and a large die-off of native American crows was confirmed. Through 2002, over 150 bird species have tested positive for the West Nile virus.

Q. Can birds transmit the West Nile virus to other birds?

A. In Fall 2000, the USGS National Wildlife Health Center in Madison, Wisconsin, conducted a study. Healthy and infected crows were placed in a common flight cage with no mosquitoes. All the birds died due to West Nile virus infection. This type of research has not been conducted in the wild, and bird-to-bird transmission in the wild has not been demonstrated to occur.

Q. How do dogs, cats, and horses become infected with West Nile virus?

A. From the bite of infectious mosquitoes, the same way humans become infected. During blood feeding, the virus is injected into the blood system of the animal. The virus then multiplies and may cause illness. It is possible that dogs and cats could become infected by eating dead, infected animals such as birds, but this is unproven.

Q. Can the West Nile virus cause illness in dogs or cats?

A. There are published reports of West Nile virus being detected in dogs and cats, but whether the animals become ill due to the virus is uncertain at this time.

Q. Have horses gotten ill or died from West Nile encephalitis?

A. Yes. While most horses infected with West Nile virus recover, results of investigations indicate that West Nile virus has caused severe illness and deaths in horses in the United States.

Q. Can infected dogs, cats, and horses carry and transmit West Nile virus to humans?

A. West Nile virus is transmitted by infectious mosquitoes. There is no documented evidence of person-to-person or animal-to-person transmission of West Nile virus. Veterinarians should take normal infection control precautions when caring for an animal suspected to have this or any viral infection.

Q. Can a horse infected with West Nile virus infect horses in neighboring stalls?

A. No. There is no documented evidence that the West Nile virus is transmitted from horse to horse.

Q. My horse is vaccinated against eastern equine encephalitis (EEE), western equine encephalitis (WEE), and Venezuelan equine encephalitis (VEE). Will these vaccines protect my horse against the West Nile virus infection?

A. No. EEE, WEE, and VEE belong to another family of viruses for which there is no cross-protection.

Q. Does a vaccine for horses against West Nile encephalitis exist?

A. Yes. A West Nile virus vaccine for horses was recently approved, but its effectiveness is unknown. Owners should keep records of the vaccination because current testing methods cannot distinguish between vaccinated and infected horses. This may affect international shipping of horses. Although a vaccine for West Nile virus is available, mosquito control is still important.

Q. How long can a dog, cat, or horse be infected with West Nile virus?

A. The answer is uncertain at this time. Previously published data on horses suggest that the virus is detectable in the blood for only a few days.

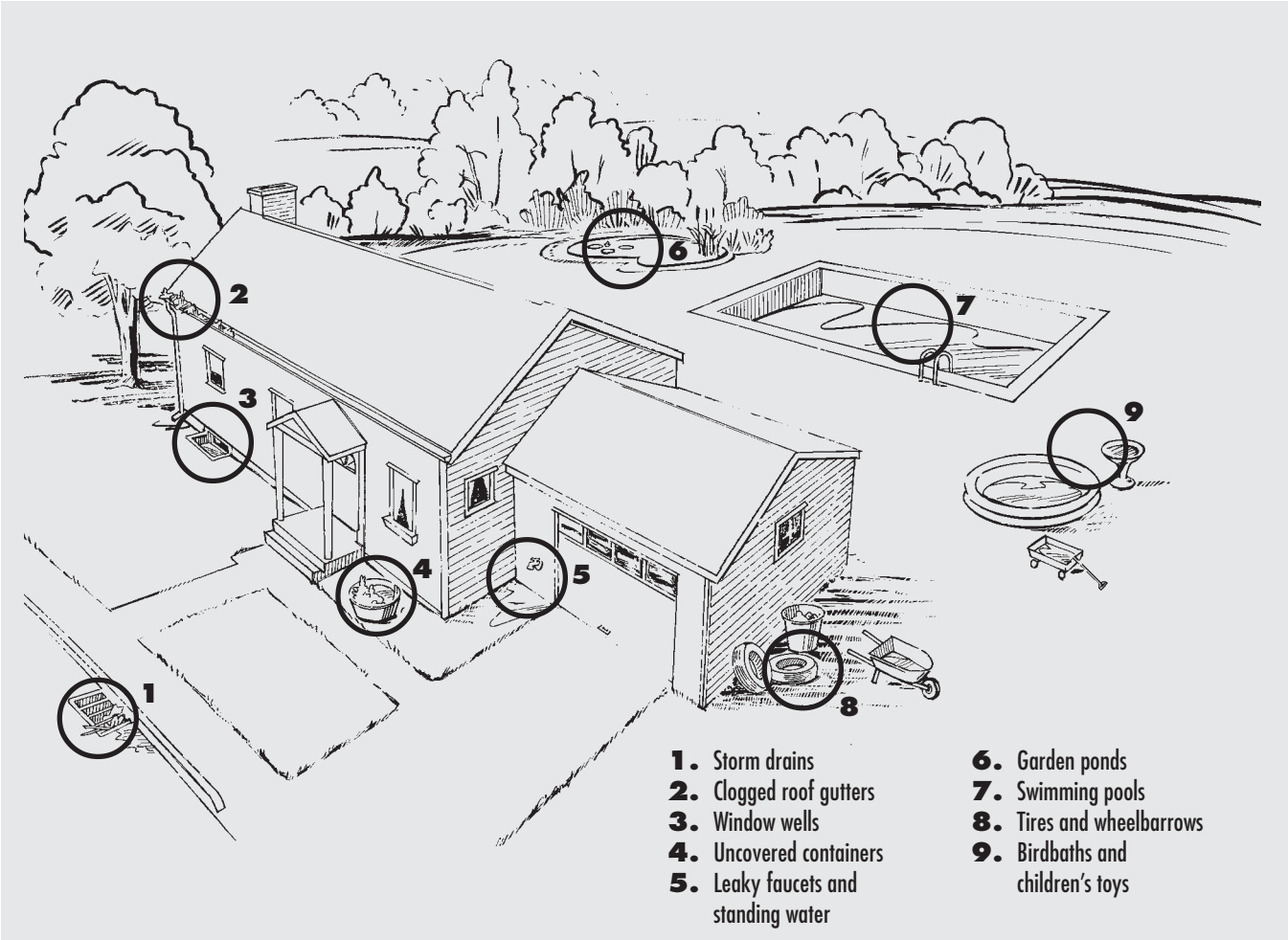
Q. Should a dog, cat, or horse infected with the West Nile virus be destroyed or treated?

A. No. There is no reason to destroy an animal just because it has been infected with the West Nile virus. Full recovery from the infection is likely for dogs and cats, and data suggest that most horses recover from the infection. Treatment should be consistent with standard veterinary practices for animals infected with a viral agent.

Q. Besides birds and horses, what other animal species have been infected with West Nile virus?

A. Many species, as well as zoo animals, have tested positive for West Nile virus including: alligators, bats, black bears, cats, chipmunks, dogs, harbor seals, mountain goats, llamas, penguins, reindeer, sheep, and storks.

Mosquito Breeding Sites



Q. Are wild game hunters at risk for West Nile virus infection?

A. Game hunters may be at risk if bitten by a mosquito, especially in areas with West Nile virus activity. The CDC does not know the extent to which the West Nile virus may be present in wild game.

Q. What should wild game hunters do to protect themselves against West Nile virus infection?

A. A hunter should follow the usual precautions when handling wild animals. If you anticipate being exposed to mosquitoes, apply insect repellents to clothing and skin, according to label instructions, to prevent mosquito bites. Wear gloves when handling and cleaning animals to prevent blood exposure to bare hands. Cook meat thoroughly.

Mosquito Pest Management and Control

Q. How can I reduce the number of mosquitoes around my home and neighborhood?

A. You can reduce the number of mosquitoes around your home and neighborhood by reducing the amount of standing water available for mosquito breeding. Here are some simple steps you can take:

- Dispose of any refuse that can hold water, such as cans and containers, that has collected on your property. Do not overlook containers that have become overgrown by aquatic vegetation.
- Pay special attention to discarded tires that may have collected on your property. Tires have become the most important mosquito breeding sites in the country.
- Drill holes in the bottom of recycled containers that are left outdoors. Containers with drainage holes on the sides can still collect enough water for mosquitoes to breed.
- Clean clogged roof gutters every year, particularly if leaves from surrounding trees tend to plug the drains. Roof gutters are easily overlooked, but they can produce millions of mosquitoes each season.
- Empty accumulated water from wheelbarrows, boats, cargo trailers, toys, and ceramic pots. If possible, turn them over when not using them.
- Turn over plastic wading pools when not in use. Check storm drains, leaky faucets, and window wells.
- Do not allow water to stagnate in birdbaths, ornamental pools, water gardens, and swimming pools or their covers. Ornamental pools can be aerated or stocked with fish. Water gardens are fashionable but become major mosquito producers if allowed to stagnate. Clean and chlorinate swimming pools that are not being used. A swimming pool left unattended for a month by a vacationing family can produce enough mosquitoes to result in neighborhood-wide complaints. Mosquitoes may even breed in water that collects on swimming pool covers.
- Alter the landscape of your property to eliminate standing water. During warm weather, mosquitoes will breed in any puddle of water.

Q. What can I do to reduce my risk of being bitten by a mosquito?

- Stay indoors at dawn, dusk, and in the early evening, when mosquitoes are most active.
- Make sure window and door screens are “bug-tight.”
- Use the proper type of lighting outside: incandescent lights attract mosquitoes, while florescent lights neither attract nor repel them.
- Wear long-sleeved shirts and long pants if you must go outdoors. Also, wear headnets when venturing into areas with high mosquito populations.
- Mosquitoes are repelled by high winds, so electric fans may provide some relief at outdoor events.
- Insect repellents can be used on your skin and clothing. Read and follow all the directions for use on the product label before applying.
- Vitamin B and “ultrasonic” devices have not been proven effective in preventing mosquito bites.

Q. Are DEET insect repellents safe for everyone?

A. DEET products have a remarkable safety record when used according to the product label. For most adults, products containing 10 to 35 percent DEET (N,N-diethyl-meta-toluamide) will provide adequate protection under most conditions. Products containing a higher concentration of DEET generally provide longer-lasting protection. However, the American Academy of Pediatrics recommends that repellents used on children contain no more than 10 percent DEET.

Q. How do you safely apply insect repellents?

- Apply insect repellent sparingly to exposed skin and clothing. Do not saturate the skin or apply beneath clothing. To apply to your face or a child, first dispense or spray it onto your palms and rub your hands together. Then apply a thin layer to your face or to your child's skin.
- Repellents may irritate the eyes and mouth, so avoid applying repellent to the hands of children. Insect repellents should not be applied to children younger than three years old or used by pregnant women.
- After applying, wipe or wash from your hands. Once indoors, wash all treated skin and clothing with soap and water.
- Whenever you use an insecticide or insect repellent, be sure to read and follow the directions for use on the product label before applying.

What Steps Are Being Taken to Monitor the West Nile Virus?

Q. What is being done at the federal level?

A. U.S. Geological Survey researchers are coordinating with the CDC, state health officials, and the U.S. Fish and Wildlife Service to conduct field investigations. They also are requesting the assistance of natural resource and conservation managers and local public health officials in a joint national surveillance effort to document crow mortality. Crows appear to be particularly vulnerable to the West Nile virus. The seasonal migration of birds has spread the West Nile virus to other areas of the United States.

Q. What is Pennsylvania doing to manage the West Nile virus?

A. The Pennsylvania Departments of Health, Environmental Protection, and Agriculture developed a comprehensive surveillance program to help detect, track, and control the West Nile virus. The plan has three parts: education, surveillance, and—if the surveillance program determines a risk—the control of mosquitoes. In addition, other state agencies, local governments, health professionals, Penn State, and the public have been very active in implementing this plan.

Q. What role does the public have in this surveillance program?

A. Most of the birds submitted for testing have been reported to state officials by the public. When you find a dead or dying bird, in particular crows, blue jays, and raptors (hawks and owls), please contact your state or local health department. In Pennsylvania, the toll-free telephone number is 1-877-PA-HEALTH (724-3258). Monitoring American crow deaths is especially important, because crows are highly sensitive to the West Nile virus. Crows act as sentinels for local transmissions of the disease.

Q. Why do some states have a mosquito control program?

A. Mosquito-borne diseases affect millions of people worldwide each year. The United States has 150 species of mosquitoes. Some can transmit diseases such as encephalitis, dengue fever, and malaria to humans. To combat mosquitoes and the potential public health hazards they present, many states and localities have established mosquito control programs. These programs can include ground and aerial application of pesticides along with nonchemical forms of control and prevention.

Pesticides Used for Mosquito Control

Q. How does the Environmental Protection Agency (EPA) ensure the safest possible use of pesticides?

A. It is a priority of EPA to protect human health and the environment and to provide support to

states dealing with serious outbreaks of infectious diseases from mosquitoes. EPA helps to ensure that states and localities use the proper pesticide application methods to reduce human exposure. EPA must evaluate and register pesticides before they may be used, sold, or distributed in the United States.

To evaluate a pesticide registration application, EPA assesses a wide variety of potential human health and environmental effects associated with use of the product. The producer of the pesticide must provide data from tests done according to EPA guidelines. These tests must determine whether a pesticide has the potential to cause adverse effects on humans, wildlife, fish, and plants, including endangered species and nontarget organisms, as well as possible contamination of surface water or groundwater from leaching, runoff, and spray drift. If a pesticide meets EPA requirements that ensure no harm to human health and the environment, the pesticide is approved for use in strict accordance with label directions. However, no pesticide is 100 percent safe, and care must be exercised in the use of any pesticide.

Q. What EPA-approved insecticides for mosquito control are available for state and local authorities to use?

A. Two types of insecticides are used, which target either mosquito adults or mosquito larvae.

Mosquito Adulticides

Malathion is an organophosphate insecticide used for mosquito control. EPA requires that Malathion be applied at very low rates by sprayers operated by state or local applicators from trucks or aircraft to ensure protection of public health and the environment. Malathion kills adult mosquitoes when they contact spray particles in the air. Mosquitoes, unlike humans, lack the enzymes that quickly break down Malathion. Thus, Malathion can be applied at low concentrations with little risk to humans.

Naled, an organophosphate insecticide, is used primarily on land to kill adult mosquitoes and blackflies. Naled is used for mosquito control primarily in the southern states, particularly Florida and other Gulf states. When applied at low concentrations for mosquito control as required by the label, Naled should pose little risk to humans. There is potential for acute and some potential for chronic risks to freshwater invertebrates from the use of Naled. Naled breaks down rapidly in soil and water.

Sumithrin is a synthetic pyrethroid insecticide used against mosquitoes in swamps, marshes, and recreational areas. It imitates natural pesticides found in chrysanthemums. Sumithrin is the active ingredient in the product Anvil 10 + 10. Sumithrin breaks down rapidly in the environment and is expected to pose little risk to humans when used at low concentrations for mosquito control.

Resmethrin, a synthetic pyrethroid insecticide, is used to control flying and crawling insects in homes, lawns, gardens, and at industrial sites. Resmethrin is the active ingredient in the product Scourge, which is used to control adult mosquitoes. It also imitates natural pesticides found in chrysanthemums. It is only registered for outdoor use and is generally applied in very small amounts. Resmethrin decomposes quickly in sunlight or when exposed to air. Resmethrin products have low toxicity to humans, but are very toxic to fish. Resmethrin products for mosquito control at or near aquatic sites are classified as Restricted Use Pesticides and may only be used by specially trained and licensed applicators.

Mosquito Larvicides

Temephos, an organophosphate insecticide, is used to control mosquito larvae. Temephos is applied most commonly by helicopters. When used according to the label, temephos does not pose unreasonable risks to human health. This chemical breaks down within a few days in water and postapplication exposure is minimal. Because temephos is applied directly to water, it is not expected to have a direct impact on land animals, but it can be highly toxic to some bird species and aquatic organisms if misused, and it is toxic to bees.

Methoprene is an insect growth regulator used to kill mosquito larvae. When used according to label directions, methoprene does not pose unreasonable risks to human health. The toxicity of methoprene to birds and fish is low, and it is nontoxic to bees. This chemical breaks down quickly in water and soil, and will not leach into groundwater.

Bacillus sphaericus and *Bacillus thuringiensis israelensis* are biological pesticides used for mosquito

larvae control in water. When the larvae eat them, these bacteria release a protein that disrupts the larva's feeding process, causing it to starve and die. *Bacillus sphaericus* and *Bacillus thuringiensis israelensis* are naturally occurring bacteria found throughout the world and are of limited toxicity to humans.

Oils are used to form a coating on top of water and *monomolecular films* are used to spread a thin film on the surface of water. Both drown larvae, pupae, and emerging adult mosquitoes. Oils are specially derived from petroleum distillates and have been used to kill aphids on crops and orchard trees. When oils and monomolecular films are used according to label directions for larva and pupa control, they do not pose a risk to human health. In addition to low toxicity, there is little opportunity for human exposure. Oils if misapplied may be toxic to fish and other aquatic organisms. Monomolecular films, when used according to the label, pose minimal risks to the environment.

Q. What should I do to reduce exposure to pesticides during mosquito control spraying?

A. EPA recommends a number of common-sense steps to help reduce possible exposure to pesticides during spraying:

- Look for notices about spraying in the newspapers and stay tuned to radio and TV for announcements.
- Whenever possible, remain indoors with the windows closed and air conditioning turned off when spraying is taking place.
- If you must stay outdoors, avoid eye contact with the spray. If you get pesticide spray in your eyes, immediately rinse them with water or eye drops.
- Your child's health should not be affected by the low levels of pesticides used in mosquito control. However, bring laundry and toys indoors before spraying begins and wash items exposed to pesticides during spraying with soap and water.
- Bring your pets indoors and cover ornamental fish ponds to avoid direct exposure.
- Cover outdoor tables and play equipment or rinse them off with water after spraying is finished.
- Cover swimming pool surfaces when feasible (given the small concentrations of pesticides used, however, special precautions or waiting periods usually are not necessary for outdoor swimming pools).
- Wash exposed skin surfaces with soap and water if you come in contact with pesticides.
- Wash any exposed fruits and vegetables, such as homegrown products or those purchased from an outside vendor, with water before storing, cooking, or eating them.
- There is no need to relocate during spraying, but consult your physician if you have serious physical or psychological concerns.
- If you think pesticides are making you sick, call the National Pesticide Information Center toll-free at 800-858-7378.

For More Information

Q. Where can I get more information?

A. The following is a list of West Nile encephalitis Web sites and phone numbers:

Centers for Disease Control and Prevention
http://www.cdc.gov/ncidod/dvbid/westnile/index.htm

United States Geological Survey, National Wildlife Health Center
http://www.nwhc.usgs.gov/research/west_nile/west_nile.html

Pennsylvania Department of Health
1-877-PA-HEALTH (724-3258)
http://www.westnile.state.pa.us/

Pesticide Education Program at Penn State
http://www.pested.psu.edu/spWestNile.html

Environmental Protection Agency
http://www.epa.gov/pesticides/factsheets/skeeters.htm

National Pesticide Information Center
800-858-7378
Call toll-free for information about the health effects of pesticides.
http://npic.orst.edu/

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