COMPREHENSIVE MOSQUITO SURVEILLANCE AND CONTROL PLAN

2019

The City of New York
DEPARTMENT OF HEALTH AND
MENTAL HYGIENE

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PREFACE

This plan summarizes New York City's Mosquito Control Program. The program's goal is to prevent New Yorkers from getting sick with mosquito-borne diseases. New York City's mosquito control is overseen by the New York City Health Department's Office of Vector Surveillance and Control.

At this time, West Nile (WN) virus is the only recognized locally-acquired mosquito-borne disease in New York City. WN virus first appeared in the Western Hemisphere in 1999. The first cluster of human cases was identified in Queens, New York City. Since then the disease has spread throughout the continental United States. WN virus is spread by *Culex* mosquitoes primarily by *Culex pipiens*, *Cx. restuans* and *Cx. salinarius*. Most people infected with WN virus have no symptoms or they experience mild illness and recover on their own. In rare cases, the virus can be deadly and cause inflammation of the spinal cord and brain.

No cases of locally-acquired Zika infection have been identified among NYC residents. A large outbreak in South America, Mexico and the Caribbean in 2016 resulted in over 1,000 travel associated Zika infections among New York City residents who traveled to affected areas. For the 2019 mosquito season, Zika prevention efforts have been incorporated into the DOHMH West Nile Virus Control Plan. Due to the absence of any evidence of Zika transmission by *Aedes albopictus* in the United States or elsewhere, Zika response activities in the City will be reduced in comparison to the 2016-2018 mosquito seasons, but still more than that in prior years.

To reduce the risk of West Nile virus and other potential mosquito-borne diseases, the DOHMH uses integrated pest management (IPM). IPM is safer and more effective than other vector control approaches. IPM relies on surveillance, education, and habitat reduction to proactively reduce mosquito populations instead of relying primarily on pesticide use.

Each mosquito season, DOHMH takes the following mosquito control steps:

- Removing standing water where mosquitoes breed
- Reducing mosquito larvae in mosquito season using environmentally safe agents
- Working with the public to reduce standing water through public outreach/education and by investigating standing water complaints reported to 311
- Surveillance of mosquito populations and disease

This document explains the technical steps of mosquito control. It is intended for vector control professionals. For general health guidance on mosquitoes and mosquito bite prevention, visit nyc.gov/health/mosquito.

EXECUTIVE SUMMARY

In 1999, New York City (City, NYC) experienced an unprecedented outbreak of encephalitis caused by West Nile (WN) virus, a mosquito-borne virus never before detected in the western hemisphere. That year, 59 cases of neuroinvasive disease (encephalitis, aseptic meningitis or acute flaccid paralysis) due to WN virus occurred in the New York City metropolitan area. Since 1999, WN virus has reappeared in NYC each year during the adult mosquito season. A total of 345 human cases of WN neuroinvasive disease (primarily encephalitis, aseptic meningitis, or acute flaccid paralysis), including 46 deaths, have occurred among NYC residents from 1999-2018. Human cases of WN fever (a less severe form of disease) have also been reported (n=73), although the undetected or unreported WN fever cases is estimated to be much higher. Over the past eighteen mosquito seasons, WN virus has established itself in most of the continental United States, emerging as a major public health problem, and causing large outbreaks of neuroinvasive disease since 2002. Last year 1,425 human cases of WN neuroinvasive disease, including 146 deaths, were identified nationwide.

In 2015, local transmission of Zika virus infection was first time identified in the Western Hemisphere in Brazil. Zika virus was originally discovered in Uganda in 1947, like WN virus it had not been seen in the Americas before. Zika virus can cause severe birth defects including microcephaly, and has also been linked to Guillain-Barre syndrome. To date no locally acquired cases of Zika virus have been identified among NYC residents; however, a large outbreak in Latin America and the Caribbean in 2016 resulted in over 1,000 travel associated Zika infections among NYC residents who traveled to affected areas. That year, minor outbreaks of Zika virus also occurred in the Florida. NYC does not have the *Aedes aegypti* species, which has been confirmed to spread Zika virus, but it does have a related mosquito *Aedes albopictus*, the Asian tiger mosquito. This species has not been implicated in the recent Zika outbreak, however, there is laboratory evidence that *Aedes albopictus* may carry and spread Zika virus.

The Department of Health and Mental Hygiene (DOHMH) routinely analyzes surveillance and control data from previous years to better prepare for the upcoming mosquito season. The 2019 Comprehensive Mosquito Surveillance and Control Plan is built on our extensive experience with West Nile virus prevention and control since 1999 and our current understanding of the Zika threat to NYC. To ensure a coordinated approach in managing mosquito-borne disease outbreaks in the City, DOHMH has worked closely with the New York State Departments of Health (NYSDOH) and Environmental Conservation (NYSDEC), the U. S. Centers for Disease Control and Prevention (CDC), and local agencies such as the Mayor's Offices of Operations (MOO) and Environmental Coordination, the New York City Emergency Management (NYCEM), Departments of Environmental Protection (DEP), Parks and Recreation (Parks, DPR), Sanitation (DSNY), Police (NYPD), Citywide Administrative Services (DCAS), Information Technology and Telecommunications (DIIT) and the New York City Housing Authority (NYCHA).

DOHMH takes a proactive approach for the prevention of mosquito-borne diseases in the City. DOHMH devotes considerable resources to a citywide effort to prevent mosquito breeding, while enhancing existing disease surveillance, and public and medical provider education activities. The goal of this plan is to prevent diseases transmitted by mosquitoes through aggressive source reduction and larviciding. If surveillance findings indicate that a

substantial risk exists for disease transmission to humans, adult mosquito control (adulticiding) is considered.

Surveillance data collected from 2000-2018 demonstrate that WN virus can be detected in mosquitoes weeks before there is a significant risk to human health. Therefore, routine surveillance of mosquito populations provides the City the opportunity to specifically target those neighborhoods and communities where the virus is re-emerging or newly emerging. The goal of early detection is to enhance mosquito control in high-risk areas in an attempt to interrupt the amplification of the virus before it has a significant impact on human health.

Despite the fact that mosquitoes are active in New York City from April through October, our mosquito prevention, surveillance and control efforts are year-round. The current Comprehensive Mosquito Surveillance and Control Plan is based on the principles of Integrated Pest Management. This plan is designed to minimize the impact of mosquito-borne diseases through citywide surveillance measures and an integrated approach to mosquito management with control practices that commensurate with the risk posed. The comprehensive nature of the plan ensures the efficacy of the control measures, while minimizing potential adverse impacts to the environment and human health from these measures. Below is a brief summary of the components of the plan:

Integrated Pest Management

Integrated Pest Management or IPM is defined as "a decision support system for the selection and use of pest control tactics, singly or harmoniously coordinated into a management strategy, based on cost/benefit analyses that take into account the interests of and impacts on people, society, and the environment" [Modified from Bajwa, W. I. and M. Kogan. 2002. Compendium of IPM Definitions (CID) - What is IPM and how is it defined in the Worldwide Literature? IPPC Publication No. 998, Oregon State University, Corvallis, OR 97331]

The objective of the DOHMH Comprehensive Mosquito Control Program is "to prevent or reduce locally transmitted human cases of mosquito-borne illnesses in the City." In the case of Zika, the Department seeks to reduce the risk that local transmission will occur, since only travel-related cases have been observed. IPM, especially for WN and Zika viruses, involves using all the tools available for prevention and control of mosquitoes and these viruses. Key components of mosquito-borne disease IPM include community outreach and education, prevention of biting of humans by vectors (infected mosquitoes), surveillance and control (non-chemical methods are considered first and if a chemical pesticide is used that it be the lowest toxicity pesticide that is efficacious on mosquitoes).

Public Education and Community Outreach

The Office of Vector Surveillance and Control (OVSC) conducts public education and community outreach through the media, advertising, presentations to community groups, and collaboration with community boards and elected officials. During the mosquito season, NYC continually posts neighborhood level surveillance data and updates on mosquito Control activities (www.nyc.gov/health/mosquito). OVSC works in collaboration with the DOHMH Bureaus of Intergovernmental and Public Affairs to increase public awareness of mosquito-borne disease risk, mosquito and disease surveillance, personal protective measures against mosquito bites, and mosquito habitat reduction. If surveillance data

indicate a possible increase in human disease risk that requires the application of pesticides to control adult mosquitoes, accurate and timely information of these mosquito control activities will be provided to the public. Communications will provide the public with application schedules, the type of pesticides being used and how to reduce exposure. Additionally, the public will be informed about what to do in the event of pesticide exposure.

Human Surveillance and Provider Education

The DOHMH system for detecting mosquito-borne diseases among humans includes passive surveillance for cases of viral encephalitis in hospitals (considered to be suspect cases of WN viral illness during peak mosquito season), and required reporting of laboratory results indicating current WN infection. Health care providers play a critical role in the detection, prevention and clinical management of mosquito-borne diseases. Advisories are sent at the beginning of the season and periodically throughout the season by e-mail to all hospitals and providers in New York City. The DOHMH's Bureau of Communicable Disease makes ongoing efforts to educate New York City health care providers regarding diseases transmitted by mosquitoes, especially WN virus, Zika virus, dengue virus and chikungunya, and encourages reporting and testing of patients with encephalitis, aseptic meningitis, fever syndromes compatible with WN fever, and other diseases possibly caused by arboviral infection. While providers are encouraged to pursue routine testing through commercial laboratories, the DOHMH Public Health Laboratory (PHL) can test blood and cerebrospinal fluid samples for WN virus in special situations. Providers can also submit specimens directly to the New York State Department of Health for WN virus PCR testing as well as testing for other arboviruses.

Management of Mosquito Populations in New York City

DOHMH's OVSC utilizes IPM techniques to manage mosquito breeding sites by eliminating, where practical, sources of standing water and treating with biological larvicides that kill the immature larval mosquitoes in areas of standing water that cannot be completely drained. DOHMH actively emphasizes, through public education and outreach efforts, the need to eliminate or report standing water. DOHMH conducts inspections following complaints of standing water and actively conducts surveillance for standing water and the presence of larvae. Mosquitoes trapped throughout the City are regularly tested for WN virus during the spring, summer, and early fall.

Mosquito Surveillance

OVSC monitors mosquitoes citywide by collecting larval and adult mosquitoes to determine mosquito distribution, density and species. DOHMH tests adult mosquitoes collected in the City for WN virus and Zika virus at the Public Health Laboratory. With testing taking place locally, the time required to receive results is minimized, allowing for increased public education, and more targeted control of larval and mosquitoes in areas with increased viral activity. Mosquito surveillance allows for targeted mosquito control activities.

Larval Mosquito Control

DOHMH will reduce mosquito breeding through the aggressive elimination of standing water and the application of larvicide to sites that cannot be emptied or drained. Through a

public information campaign, DOHMH will urge residents to eliminate breeding sites around their homes and commercial properties and to report potential standing water in their neighborhoods. DOHMH will collaborate with elected officials, other City agencies and large property owners to eliminate standing water in empty lots, tire piles and other containers. DOHMH will also aggressively enforce the NYC Health Code which requires elimination of standing water from properties throughout the City. These activities will be augmented with the application of larvicide to potential breeding sites where water cannot be eliminated which includes catch basins citywide and natural mosquito breeding habitats. When WN or Zika virus is detected in an area, DOHMH will increase public education, breeding site reduction activities, and larviciding.

Adult Mosquito Control

A timely and appropriate response to mosquito and human surveillance findings is key to preventing an outbreak of human disease. DOHMH will implement a phased response to surveillance findings that will expand education, prevention, and control activities in relation to the threat of an outbreak of human disease. If surveillance indicators meet established thresholds indicating that the level of WN virus activity poses a significant threat to human health, adult mosquitoes will be controlled through the use of adulticides. Mosquito density and distribution, mosquito species, persistence of WN virus activity, weather, time of year, and the proximity to human populations will be carefully considered in determining the necessity for adult mosquito control. The accuracy, quality, and efficacy of the adulticide application will be closely monitored to ensure compliance with Federal and State guidelines. If application of adulticides becomes necessary, DOHMH will provide advance notice to the public and to health care providers.

Surveillance of Potential Adverse Health Effects from Pesticide Exposure

DOHMH completed a comprehensive environmental impact study (EIS) on the pesticides used for adult mosquito control in 2001. The department filed a Technical Memo updating the EIS in 2017. This study concluded that at the relatively low levels at which adulticides are applied, the occurrence of adverse public health effects to the population from applying pesticides to reduce the adult mosquito population would not be considered significant when compared to the potential risk to the public health from WN virus or other diseases spread by mosquitoes. However, health care professionals are informed and reminded throughout the mosquito season about potential health effects of pesticide exposure and the need to report pesticide-related illness to DOHMH and NYSDOH. DOHMH monitors the adverse health effects associated with the application of pesticides for adult mosquito control through syndromic surveillance. Additional pesticide products have been approved for use in NYC by state and federal agencies. DOHMH will continue to assess the health effects of these and any products considered for use for its mosquito control program.

Research and Evaluation

DOHMH uses its surveillance data to help determine where mosquito breeding occurs in New York City and how WN virus and other diseases spread by mosquitoes are maintained in our environment. DOHMH evaluates surveillance indicators that signal a threat to human health and to assess the efficacy of larval and adult mosquito control activities.

INTRODUCTION

New York City experienced recurring outbreaks of yellow fever and malaria in the nineteenth century and early parts of the twentieth century, respectively. In present times, West Nile (WN) virus is the only mosquito-borne disease that has been transmitted by local mosquitoes in the City. WN virus is primarily transmitted by *Culex* mosquitoes. The City does not have the *Aedes aegypti* species, which has been demonstrated to spread Zika virus, but it does have related mosquitoes in the *Aedes* genus. Although there is laboratory evidence that *Ae. albopictus* may carry Zika virus, this species has not been implicated in the recent outbreak, nor has its competence as a vector been demonstrated.

In late August of 1999, the New York City Department of Health and Mental Hygiene (DOHMH) detected an unusual cluster of encephalitis cases in northern Queens. This was caused by WN virus, a mosquito-borne virus that had not been recognized in the Western Hemisphere prior to 1999. In 1999, the outbreak resulted in 59 cases of neuroinvasive disease of which 44 were NYC residents who were hospitalized. There were 4 fatalities resulting from WN virus infection.

Since its introduction to New York City in 1999, WN virus has caused successive outbreaks in the United States each summer and fall, and has moved steadily westward. In 2003, WN virus caused the largest outbreak of neuroinvasive disease ever recorded in the Western Hemisphere, with 9,862 cases reported overall, including 264 deaths. In New York City, the virus has persisted and has become endemic, causing at least 345 neuroinvasive cases and 46 deaths. From 2000-2018, the number of neuroinvasive cases due to WN virus among New York City residents has ranged from 2 to 45 (median 17) per year.

In 2018, 36 cases (30 neuroinvasive and 6 fever) of WN disease were detected among New York City residents, almost all of which were possibly or probably acquired in New York City**.**

Data from the CDC indicate that there were 2,544 human cases (1,594 neuroinvasive and 950 fever) and 137 human deaths reported in the United States in 2018. For more information, please refer to the CDC homepage (www.cdc.gov/westnile/).

Since 2003, universal screening of donated blood products has been conducted in New York City by the New York Blood Center, and 18 presumptively infected donors have been identified in New York City between 2003-2018. All implicated blood products were retrieved and removed from the blood supply.

The reoccurrence of human cases of WN virus every year and repeated identification of WN virus activity in mosquitoes provides ample evidence that this virus has permanently established in New York City and the United States. With the establishment of WN virus, having a routine, year-round, integrated pest management program has become a necessity.
There are three probable mechanisms for WN virus sustainability within the City. The principle enzootic vector, *Culex pipiens*, overwinters in the adult stage and it is believed that at least some infected mosquitoes successfully survive the winter. Alternatively, infected birds that remain in the area may harbor the virus throughout the winter months. As spring

returns, the virus recrudesces within the bird populations and is readily passed to early season mosquitoes. A third mechanism is reintroduction of the virus into the area during the spring or early summer by infected migratory birds. Hence, a number of infected mosquitoes and/or birds are present within the City during the early spring months. At this time, the virus resumes its amplification cycle. As mosquitoes feed on birds, the virus is transmitted back and forth between the vector and the reservoir host populations allowing an increasing number of birds and mosquitoes to become infected. If environmental conditions are optimum for transmission, the virus amplifies to a theoretical point of "spill over". At this point in the amplification cycle, the virus bridges out of the enzootic, bird-mosquito cycle via bridge vectors. Bridge vectors are mosquito species that readily feed on humans and other mammals. It is at this point in the season, that transmission to humans occurs and when management actions are most critical.

An effective surveillance and control program is designed to detect WN virus during the amplification cycle before it spills over into humans. Typically, infected mosquitoes signal the presence of local WN virus activity, and occur a month or more prior to human transmission. The goal of DOHMH's vector surveillance program is to detect the WN virus in local mosquito populations before sufficient amplification of the virus can occur, allowing for the execution of targeted IPM practices, thereby reducing the number of infected mosquitoes and simultaneously reducing the risk of human transmission.

For the 2019 mosquito season, Zika surveillance and control efforts have been incorporated into the DOHMH Comprehensive Mosquito Control Plan, unifying both WN and Zika virus control efforts as part of routine agency business. Due to the absence of any evidence of Zika transmission by mosquitoes native to NYC (including *Ae. albopictus*) in the United States or elsewhere, response activities will be reduced in comparison to the 2016-2018 mosquito seasons, but still above those in prior years. In the event of one or more locally-acquired cases or detection of Zika virus in local NYC mosquito populations, DOHMH would expand its response activities as detailed below:

- Strengthen its neighborhood-based effort to identify and treat standing pools of water in private homes, commercial buildings, and public places
- Increase the frequency and reach of source control activities to eliminate larval habitats
- Apply larvicide and adulticide to affected areas
- Distribute mosquito repellent in the affected neighborhood(s)

DOHMH extends its gratitude to the following collaborators with whom it has worked closely to develop a plan that meets the specific needs of New York City: the U.S. Centers for Disease Control and Prevention (CDC); the New York State Departments of Health (NYSDOH), Environmental Conservation (NYSDEC), Agriculture and Markets; and New York City agencies, including the New York City Emergency Management Department and the Departments of Environmental Protection, Parks and Recreation, Sanitation, Police, Citywide Administrative Services, Information Technology and Telecommunications, the New York City Housing Authority, Wildlife Conservation Society and its other partners.

INTEGRATED PEST MANAGEMENT (IPM)

Prevention of Mosquitoes and Mosquito-borne illnesses in Humans

Prevention is the key to the DOHMH mosquito IPM program. OVSC focuses its prevention efforts on source reduction, identifying locations of key permanent and semi-permanent breeding sites, and larviciding (backpack, aerial and catch basin). A major part of breeding source reduction involves citywide community outreach and education to engage the help of the public. Preventing the mosquito larvae from emerging into adults is the easiest and most environmentally-sound way to reduce the number of mosquitoes that may transmit West Nile virus in New York City. Larval habitats or breeding sources include stagnant water in artificial and natural containers (tires, birdbaths, tin cans, clogged gutters, puddles, pot holes, tree holes) or an open area (flood-prone areas, marsh areas and other wetlands).

Key recommendations for preventing WN virus in humans include:

a) People, especially those 50 and older or those with underlying health conditions, should take special care to prevent WN virus because they are more susceptible to severe WN virus symptoms
b) Know the symptoms of diseases
c) If outside at dusk or dawn, or if mosquitoes are biting during the day, wear long pants, long-sleeved shirts and socks
d) Consider the use of an EPA and DEC approved insect repellent containing: 2-undecanone, DEET picaridin, IR3535, or oil of lemon eucalyptus according to the label's directions
e) Make sure doors and windows have tight-fitting screens. Repair or replace screens that have tears or holes
f) Reduce the number of mosquitoes in your area by getting rid of containers with standing water that provide breeding places for the mosquitoes.

Community Outreach and Education

Getting the message out to the public regarding personal prevention and breeding source reduction is a major part of this comprehensive mosquito control plan. The more people know about mosquitoes and WN virus and other diseases spread by mosquitoes, the better they can protect themselves and help in reducing breeding sources. The OVSC conducts community outreach and education through presentations and also provides information through its website (www1.nyc.gov/site/doh/health/health-topics/west-nile-virus.page) and with literature on the personal prevention of WN and Zika virus.

Surveillance

The DOHMH mosquito-borne disease surveillance program includes 1) monitoring of human cases, 2) "in-season" surveillance of larval and adult mosquitoes, 3) "off-season" surveillance of overwintering adult mosquitoes, and 4) identification and characterization of

breeding sites.

Larval surveillance helps OVSC to determine where to treat by ground equipment (manual and backpack pesticide applicators) and determine the timing for aerial larviciding. Larval surveillance includes dipping, breeding site identification and larval identification. Dipping is performed by taking a small amount of water using a sampling device called "dipper" and examining the sample for the presence or absence of mosquito larvae.

Adult mosquito surveillance is key to determining the type and density of mosquitoes present throughout the City and through their testing to determine the presence, location and intensity of WN virus. The mosquitoes are trapped using light and gravid traps in about 275 (2018) locations strategically located throughout the City. Locations of these traps are based on current and past surveillance data. If WN or any other mosquito-borne virus is found in a location, supplemental traps are added to better define the distribution of WN virus in the area.

Control: Control of mosquitoes using the principles of IPM includes 1) breeding source reduction, 2) habitat modification, 3) use of mass mosquito-trapping devices, 4) larviciding and 5) adulticiding. Non-chemical methods are always considered first, but if a chemical pesticide is required, then the lowest toxicity (and least persistent) pesticide that is efficacious on mosquitoes will be used.

Larviciding: Larviciding is the most efficient method of controlling mosquitoes. By larviciding aquatic breeding sites with naturally occurring biological pesticides, the larvae are killed before they emerge from water into adults. The larviciding effort includes 1) manual or backpack treatment of key breeding source locations, 2) manual treatment of catchbasins, and 3) aerial application to inaccessible breeding areas.

Adulticiding: DOHMH performs adulticiding only as a last resort, when WN or other mosquito-borne virus infected mosquitoes have been identified and meet established criteria for adulticiding. The decision to adulticide is based on data obtained from mosquito surveillance and testing, and established and successful algorithms/decision trees.

For Zika virus, adulticide will be applied only when there are high numbers of imported human cases in specific areas of the city where *Aedes albopictus* is also abundant and/or upon detection of Zika virus in *Ae. albopictus* mosquitoes, or if there are human cases that are locally acquired. For WN virus, OVSC uses two different algorithms depending on whether or not a human WN virus case is involved. The Positive Mosquito Pool Algorithm is driven by 1) the presence of WN virus in mosquitoes, 2) the persistence (ongoing activity) of WN virus in locations where positive mosquitoes were found, 3) the competency of infected mosquito species in transmitting WN virus, 4) the propensity of WN virus positive mosquito to bite humans and 5) the population density in areas where WN virus positive mosquitoes were trapped. The Positive Human Case Algorithm is driven by 1) the presence of human case(s) in an area and 2) the evidence of local transmission of the virus (presence of positive WN virus mosquitoes in area near the human case). Detailed descriptions of above mentioned mosquito IPM practices are provided in the succeeding sections of this plan.

PUBLIC EDUCATION & COMMUNITY OUTREACH

Objective

To increase public awareness of mosquito-borne diseases and prevention

Background

Each year, DOHMH launches a public education initiative, called "Fight the Bite" to increase awareness of mosquito bite prevention, standing water reduction, West Nile virus, and other diseases spread by mosquitoes.

At the beginning of each season, DOHMH releases a Health Advisory to notify the public on the risk of WN virus and other diseases spread by mosquitoes and to educate them on personal protection strategies. In past campaigns, this message was aired on television and radio and published in newspapers and magazines. DOHMH has developed educational fact sheets on mosquito bite prevention and standing water in multiple languages for distribution to community-based organizations, community boards, elected officials, schools and the general public. This information can also be downloaded from the DOHMH's website (www.nyc.gov/health/mosquitoes). The campaign also features presentations and other outreach activities from DOHMH staff to various community groups in the neighborhoods with higher risk of WN virus infection.

DOHMH promotes mosquito-borne disease prevention strategies and community participation in mosquito control program. During 2018, the OVSC participated in 112 outreach events which included participating in community meetings, attending health fairs, and presentations targeting populations at highest risk for WN virus infection. The Press Office made spray notifications and personal precaution announcements through the media and created 34 press releases relating to mosquito control events in the City. Through collaboration, educational materials were made widely available in hard copy and electronic form (through email and the Agency's website), in multiple languages. Information was also made available through 311.

In 2019, DOHMH will take standing water and mosquito infestation reports via the New York City's Citizen Service Center (311) and DOHMH's enhanced Web site (www.nyc.gov/health/mosquito). Callers can receive comprehensive information about WN and Zika viruses, including updated information about adulticiding (mosquito spraying) schedules by dialing 311. The Citizen Service Center will provide callers with a live operator 24 hours a day, 7 days a week. DOHMH will also provide information on WN and Zika viruses through its web site (www.nyc.gov/health/mosquitoes) in the form of fact sheets, press releases, larviciding, mosquito control schedules, and WN virus activity maps. This information is routinely faxed and/or electronically mailed to City agencies, elected officials, community boards, the Department of Education, hospitals, nursing homes, and associations of green grocers, day camps, and community organizations. DOHMH will work with the Department for the Aging (DFTA) for distribution of WN virus messaging and DCAS (Department of Citywide Administrative Services) on preventing the breeding of mosquitoes on publicly owned property.

Adulticiding information is made available through DOHMH's web site and 311, regular news broadcasts, scheduled advertising times on local radio, print media, and web sites of news organizations.

To raise awareness of mosquito control events, the DOHMH uses the Notify NYC System to reach out to the public in areas at higher risk of disease transmission during adulticiding events. This system allows residents of the City to receive alerts on many different communication devices such as cell phones, landlines, pagers, and email accounts. The public is encouraged to register with Notify NYC via 311 or the web, to receive advanced notification of ground spray (adulticiding) and aerial larviciding events in their neighborhoods. In addition, prior to each event, the DOHMH places posters up in high trafficked areas of affected communities to alert them of the event.

Planned Activities

- The public will be informed about the City's comprehensive preventive strategies and activities (community education, surveillance, source reduction, larviciding, etc.) to address the threat of diseases spread by mosquitoes and to minimize the necessity of pesticide application for adult mosquito control.
- The public will be asked to help eliminate mosquito-breeding sites and to report standing water using the Citizen Service Center (311) and via DOHMH's Website (www1.nyc.gov/site/doh/health/health-topics/west-nile-virus.page). The public will be advised to eliminate standing water sites (tires, buckets, and other water-holding objects) where mosquitoes can breed from their property. They will also be urged to change the water in bird baths once each week; to clean and chlorinate swimming pools or drain and cover if not in use; to prevent water from accumulating in pool covers; and to unclog gutters and down spouts.
- The OVSC will conduct outreach on WN virus prevention and habitat reduction, focusing on populations at highest risk of disease transmission.
- The Office of Community Affairs will assist in increasing public awareness of the nature of mosquito-borne diseases
- The public will be informed about the proper personal protective measures to avoid mosquito bites such as ensuring that screens fit tightly on doors and windows, wearing protective clothing (long pants, long-sleeved shirts, and socks) and appropriate use of insect repellents.
- Maps and tables showing recent WN virus activity by zip code will be posted on the DOHMH website in order to provide the public with up to date information on location of WN virus activity in the City. This information will be updated on a weekly basis until viral activity has ceased.
- Fact sheets in several languages will be distributed to community-based organizations, community boards, elected officials, schools, senior care facilities, libraries, outdoor activity sites, and many other organizations citywide.
- The Citizen Service Center (311) will be updated regularly with information

pertaining to DOHMH pesticide spraying activities. This service will begin on April 1 and will be available 24 hours a day, 7 days a week for WN virus related inquiries.

- DOHMH's web site (nyc.gov/health/mosquito) will be regularly updated and, beginning in April, the public can use web-based forms for reporting standing water.
- Regular updates will be made to elected officials and community boards, who are essential to the City's communication activities about WN virus activity. Presentations, available in multiple languages, will be offered by DOHMH staff to community boards and a wide variety of organizations. These will include information about mosquito breeding site reduction and related DOHMH activities.
- Press releases regarding all activities will be issued regularly and DOHMH will work closely with the media to achieve accuracy of the media's coverage.
- If the application of pesticides to control adult mosquitoes becomes necessary, the public will be informed in a timely manner (at least 24 hours in advance with a goal of 48 hours prior to event) to reduce exposure to pesticides. The public will also be provided detailed information about the pesticides being used and the potential risks associated with exposure. The public will be encouraged to contact the Poison Control Hotline (212-POISONS/764-7667 or 1-800-222-1222) with any suspected pesticide-related illness, symptoms or exposure.
- Information will be released at least 24 hours in advance (in compliance with Local Law 37 and NYS DEC Regulation) with a goal of 48 hours in advance through the media, DOHMH Website, Citizen Service Center (311), and Notify NYC (if applicable). In addition, hospitals, key City agencies, elected officials, community boards, schools, nursing homes, day camps, and community organizations will receive notice via fax and/or electronic email. Under certain conditions and with the approval of the NYSDOH, applications in green spaces (parks/cemeteries) may take place with less than the required 24 hour notice. For these cases, the green area will be closed to the public during and a few hours after the application of adulticide.
- Posters will be placed in public areas alerting residents of the upcoming spray event.
- Police Department cars or other vehicles will escort the DOHMH applicator's trucks to announce that adulticiding is about to take place, and will urge people to go indoors in order to reduce exposure to pesticides.

HUMAN SURVEILLANCE AND PROVIDER EDUCATION

Objective

To quickly detect human illness due to mosquito-borne diseases, especially WN virus

From 1999-2018, 345 New York City residents were reported with neuroinvasive disease due to WN virus. Among these cases, 46 died as a result of West Nile infection. Most of the neuroinvasive cases have occurred in older New Yorkers **(**median: 65 years; range 1-93). Seventy-three (73) cases of WN fever were also detected during this time period. In 2018, 30 New York City residents were diagnosed with WN neuroinvasive disease. All but one of these cases of WN viral disease probably became infected locally. The tables below summarize WN virus disease by borough and syndrome.

West Nile Viral Disease by Borough, NYC, 1999-2018 (includes neuroinvasive and non-neuroinvasive cases)

Year	Bronx	Brooklyn	Manhattan	Queens	Staten Island	Total
2018	4	7	6	18	1	36
2017	0	9	4	8	0	21
2016	0	2	0	2	2	6
2015	2	12	1	17	6	38
2014	1	5	2	5	2	15
2013	1	3	0	2	4	10
2012	4	12	9	10	6	41
2011	2	2	2	5	0	11
2010	7	6	6	14	9	42
2009	1	1	0	1	0	3
2008	1	3	1	5	5	15
2007	2	7	1	7	1	18
2006	1	0	1	2	8	12
2005	3	3	1	5	2	14
2004	0	0	3	1	1	5
2003	6	8	3	11	4	32
2002	9	2	2	12	4	29
2001	0	2	3	2	2	9
2000	0	2	1	1	10	14
1999	9	3	1	34	0	47
Total Cases	**53**	**89**	**47**	**162**	**67**	**418**

The table below summarizes morbidity and mortality due to WN virus in New York City from 1999-2018:

West Nile Viral Disease, NYC, 1999-2018

Year	Cases	Syndrome		Median Age*		Deaths	
		Neuroinvasive	WN Fever	Yrs	Range	#	Case Fatality Rate*
2018	36	30	6	60.5	(33-88)	2	7%
2017	21	20	1	62.5	(28-87)	2	10%
2016	6	6	0	49.5	(32-77)	0	-
2015	38	30	8	59	(22-89)	4	14%
2014	15	12	3	59	(36-81)	3	25%
2013	10	8	2	64	(45-81)	0	--
2012	41	26	15	60.5	(1-88)	6	23%
2011	11	9	2	69	(41-82)	2	22%
2010	42	34	8	64	(19-87)	1	3%
2009	3	3	0	63	(60-73)	0	--
2008	15	8	7	64	(33-87)	1	13%
2007	18	13	5	75	(41-90)	5	38%
2006	12	8	4	64.5	(44-80)	2	25%
2005	14	11	3	61	(27-84)	2	18%
2004	5	2	3	34	(1-66)	0	--
2003	32	31	1	67	(8-93)	7	23%
2002	29	28	1	72	(22-86)	3	11%
2001	9	7	2	51	(44-75)	1	14%
2000	14	14	0	62	(36-87)	1	7%
1999	47	45	2	71	(5-90)	4	9%
Summary	**418**	**345**	**73**	**65**	**(1-93)**	**46**	**13%**

* Median age and case fatality rate calculated for neuroinvasive cases only.

Serosurveys performed in Queens (1999) and Staten Island (2000) provided an estimate of the proportion of WN viral infections that are asymptomatic or subclinical. Accordingly, an estimated 140 subclinical WN virus infections, and an additional 30 cases of WN fever, occur for each case of neuroinvasive disease. Therefore, approximately 48,300 asymptomatic infections and 2 10,350 cases of WN fever have likely occurred among New York City residents from 1999-2018. The majority of asymptomatic infections and WN fever cases are undetected and unreported in New York City, since many individuals with febrile illness may not seek medical attention and may not be tested for WN virus even if they do see a healthcare provider.

As part of a surveillance and provider education program, the Bureau of Communicable Disease offers presentations to health care providers. Medical alerts and advisories are issued via the Health Alert Network (broadcast e-mail) to all NYC hospitals and providers, encouraging providers to consider WN virus testing for any patients presenting with encephalitis, aseptic meningitis and acute flaccid paralysis from July through October. In July, 2010, the DOHMH Public Health Laboratory discontinued routine serologic testing for WN virus. Providers are asked to send specimens to commercial laboratories for WN virus testing. Under special circumstances specimen transportation and testing is arranged by DOHMH (e.g. high suspicion for WN virus, possible transfusion or transplantation related case or unusual clustering suggestive of an outbreak of WN virus or another cause of encephalitis).

If physicians request antibody testing for other arboviruses, such as dengue, eastern equine encephalitis and/or St. Louis encephalitis (SLE) viruses, specimens can also be referred to the NYSDOH Wadsworth Laboratory or the Centers for Disease Control and Prevention (CDC) for testing. Physicians may send cerebrospinal fluid (CSF) specimens from hospitalized patients with encephalitis to the Wadsworth Laboratory New York State Department of Health (NYSDOH) for testing by polymerase chain reaction (PCR) for a panel of viruses that cause human encephalitis.

In addition to West Nile, several other mosquito-borne infections have been diagnosed among NYC residents. Cases of dengue fever are detected every year. Investigations have determined that all infections were acquired outside NYC in areas where dengue is known to be endemic. NYC reported 75 cases of dengue in 2015, 96 in 2016, and 32 in 2017. In 2014 a new outbreak of chikungunya virus in the Caribbean resulted in over 600 cases identified among NYC residents. The numbers declined with 94 cases reported in 2015, 27 in 2016, and 13 in 2017. Interviews with the patients revealed all the patients had acquired their infection while traveling in the Caribbean and Central and South America. While no cases of Zika virus infection were identified among NYC residents in 2015, a large outbreak in Latin America, Mexico and the Caribbean that year resulted in 993 travel associated Zika infections among NYC residents who traveled to affected areas in 2016. As the outbreak winded in the affected areas, the number or cases in NYC declined and in 2017, 130 cases were reported. Zika virus is expected to become endemic in the currently infected areas, and we will continue to conduct human surveillance to identify travel associated cases among NYC residents. DOHMH conducts passive surveillance for dengue virus, chikungunya virus and Zika virus infections, and facilitates testing for new arboviruses not normally found among NYC residents.

Planned Activities

- Beginning in early July, DOHMH will remind providers to report all suspected cases of WN virus neuroinvasive disease (encephalitis, aseptic meningitis or acute flaccid paralysis), and to test all hospitalized patients with these conditions for WN virus. Providers will also be reminded to consider dengue, chikungunya and Zika in patients with a history of travel and compatible illness.
- From July through October, periodic e-mail advisories will be sent to all City hospitals and healthcare providers describing current WN virus activity in NYC and

emphasizing the importance of reporting suspected WN virus cases. DOHMH will provide the criteria for reporting and submission of appropriate laboratory specimens for WN virus testing.

- DOHMH will work closely with NYSDOH and CDC to ensure that surveillance data are standardized and remain confidential.
- DOHMH will educate health care providers to increase knowledge about the proper detection, prevention and clinical management of mosquito-borne diseases and other types of encephalitis and meningitis.
- Presentations will be made at local hospitals and to specialty societies as requested.
- The Bureau of Communicable Disease will work with partners to ensure that cases of WN virus infection in persons who have received or donated blood products or organs are rapidly investigated and reported so that other affected blood products or organs can be promptly identified and withdrawn before they are used.
- BCD will facilitate diagnostic testing for cases in which arboviral diseases other than WN virus, dengue, chikungunya or Zika are suspected by clinicians.

MOSQUITO SURVEILLANCE

Objective

To monitor the abundance of mosquito populations and detect the presence of arboviruses

Background

The risk of mosquito-borne disease depends on the number of mosquitoes capable of transmitting the virus and the prevalence of the virus within those mosquitoes. Proper surveillance data for larval and adult mosquitoes are important for guiding appropriate prevention and control activities. Larval surveillance can help predict expected adult mosquito density and can indicate areas where efforts to eliminate mosquitoes at their source (breeding sites) should be targeted. Adult mosquito surveillance and viral testing provide early predictive information about the potential for a disease outbreak

For the 2019 mosquito season (April-October), DOHMH will conduct weekly surveillance at 71 permanent trap locations strategically placed throughout the five boroughs. To monitor adult mosquito populations, DOHMH uses light traps, gravid traps, and BG (Biogents®) sentinel traps. Light traps and gravid traps are placed as pairs at 61 sites to estimate risk of WN virus transmission to humans. Light traps attract female mosquitoes searching for blood meals and are used to estimate the size of mosquito populations, while gravid traps attract fertilized female *Culex* mosquitoes which already have had blood meals and are more likely to test positive for WN virus. In 2016, DOHMH began using BG sentinel traps at 60 additional locations. BG traps are more efficient in trapping *Aedes* mosquitoes which are potential vectors of Zika, chikungunya and dengue. At present, these diseases do not occur in New York City. OVSC utilized mosquito and human data (travel-related Zika cases) from the 2016 seasons to guide its adult mosquito surveillance for Zika virus in 2017 and 2018 in neighborhoods at highest risk. Given the marked decrease in Zika activity in affected areas in South and Central America and the Caribbean by the end of 2018, the DOHMH response will be adjusted accordingly given that the risk of both travel-related cases and local transmission is significantly reduced. In 2019, DOHMH will use BG sentinel traps at only 10 additional sites to monitor the density of *Aedes* mosquitoes in NYC. Due to the low risk of local transmission, *Aedes* mosquitoes will not be tested for Zika virus. Mosquitoes collected from BG sentinel traps will be tested only for WN virus.

Field collected mosquitoes are sorted by species and grouped into pools of up to 50 mosquitoes for virus infection analysis. *Culex* and *Aedes* mosquitoes were tested for WN virus infection. In 2018, the DOHMH collected and identified 145,696 mosquitoes by species. Of the 4,046 mosquito pools (110,259 mosquitoes) tested for WN virus, 1,024 tested positive for WN virus in eight different species (*Coq. perturbans*, Cx. erraticus, *Cx. pipiens*, *Cx. restuans*, *Cx. salinarius*, *Ae. albopictus*, *Ae. taeniorhynchus* and *Ae. vexans vexans*). Our results from 1999 to date indicate that *Cx. pipiens* is the primary vector of WN virus in NYC.

In addition to conducting disease focused adult mosquito surveillance during mosquito

season, DOHMH monitors adult mosquito populations in selected locations to monitor overwintering populations during the winter.

Planned Activities

- DOHMH will continue to work closely with other City agencies to collect and map information on potential mosquito-breeding habitats.

- DOHMH will determine which areas should be regularly inspected for the presence of larvae. These sites will be subjected to routine inspection to determine the presence of mosquito larvae and need for treatment.

- Larval habitat information will be collected and updated throughout the season.

- In targeted urban areas, mosquito trapping will be conducted from sewer and adjacent buildings by using light traps in response to resident complaints.

- From April through October, DOHMH will conduct adult mosquito surveillance of at 81 permanent trap locations strategically placed throughout the five boroughs using three different types of traps. The trapping season may be lengthened or shortened depending on the weather.

- Mosquitoes will be collected on a weekly basis using light, gravid and sentinel traps. Each trap collection will be sorted by species of mosquitoes collected. Information on the location, collection data, trap type and the total number of female mosquitoes will be recorded.

- Adult mosquito trapping will be expanded in areas where traps indicate increased disease risk. This will help determine extent of risk and determine control methods.

- In the event that pesticides are applied for adult mosquito control, DOHMH will set traps more frequently to evaluate the efficacy of the control measures.

- Mosquito Magnet™ traps will be used to survey and control adult mosquitoes at parks and wastewater treatment plants. Additionally, DOHMH will place Mosquito Magnet™ traps to survey and control adult mosquitoes in the Rockaways.

LARVAL MOSQUITO CONTROL

Objective

To reduce the abundance of adult mosquitoes through the use of Integrated Mosquito Management (IMM) practices

Background

Mosquitoes breed in water. Eliminating their breeding sites is the simplest and most effective way to reduce the number of mosquitoes. Every residential and commercial property owner should regularly inspect their property to determine if conditions are conducive to mosquito breeding and attempt to eliminate those conditions. Mosquito breeding can be prevented by either eliminating the standing water (source reduction), or treating the water with larvicide to prevent mosquitoes from developing.

Culex pipiens, a primary vector of WN virus and one of the most common mosquitoes found in New York City, lays its eggs in standing or slow-moving water containing decaying organic materials. Important breeding sites for *Cx. pipiens* include storm drains (catch basins), used tires, poorly maintained bird baths, clogged rain gutters, unused swimming and plastic wading pools, and puddles that last for a week or more. A single female *Cx pipiens* can lay between 100 to 300 eggs. These eggs can mature to adults within 10 days under ideal conditions. Larvae of *Ae. vexans, Cx. salinarius, Ae. sollicitans, Ae. taeniorhynchus,* and *Coquillettidia perturbans,* can be found in either freshwater or saltwater marshes. *Ae. albopictus* and *Ae. japonicus,* are container breeding mosquitoes that require minimal amounts of water for egg and larval development. These species prefer to lay their eggs in natural and unnatural containers that are easily overlooked, such as tree holes and discarded trash. *Ae. albopictus* is a vicious day-biting mosquito that has the capability to transmit several mosquito-borne human illnesses. Public education on identifying and removing these larval habitats from residential properties is an integral component to reduce populations of these species.

DOHMH's public education campaign emphasizes the need for New Yorkers to eliminate mosquito-breeding sites around their homes. Standing water is a violation of the New York City Public Health Code and residents are encouraged to report standing water that can potentially breed mosquitoes to 311. Reports of standing water are investigated by DOHMH inspectors. When standing water is found in violation, the private property owner receives a Notice of Violation and is called for a hearing by the Environmental Control Board. Standing water may also be referred for extermination by the inspector or will be referred to the proper agency for evaluation and remediation if the water is identified on public property.

In 2018, DOHMH received 2,996 complaints of standing water through 311, on the DOHMH web site, from elected officials and community groups, and through field surveys performed by inspectors and exterminators. The DOHMH investigated each of the complaints and as a result of these inspections, 922 Notice of Violations were issued to unresponsive landlords and homeowners.

DOHMH will conduct need-based larviciding in accordance with permits issued by NYS Department of Environmental Conservation (DEC) in catch basins (street corner storm drains), sewage treatment plants, and areas of permanent standing water. DOHMH works with the New York City Department of Environmental Protection (DEP), the New York City Housing Authority, and the New York City Department of Parks and Recreation to treat catch basins and other mosquito breeding sites

Approximately 150,000 catch basins across the City will be inspected and if justified, treated at least three times each season by hand application of larvicides. In natural areas that are inaccessible by ground vehicles, larvicide may be applied aerially by helicopter periodically during mosquito season. DOHMH plans to continue using all of these methods in 2019.

Presently, DOHMH uses larvicides with the active ingredients *Bacillus sphaericus*, *B. thuringiensis* var. *israelensis* (*Bti*) and/or methoprene. *B. sphaericus* and *Bti* are naturally occurring soil bacteria that produce toxins, which can be used to control mosquito larvae. These microbial larvicides are ideal for mosquito management because of their specificity to mosquitoes and their lack of toxicity to humans and other non-target organisms. The bacteria produce unique crystalline bodies (endotoxins) that when eaten, dissolve in the intestine of the larvae and paralyze the cells in the gut, thus interfering with normal digestion and triggering the larvae to stop feeding. The spores can then invade other tissues, multiplying in the larva's blood, until the insect dies. Death typically occurs within a few hours of ingestion.

Planned Activities

- DOHMH and other City agencies continuously identify areas of standing water associated with surface grading problems, road construction, clogged sewers and catch basins, obstructed waterways that are mosquito-breeding habitat. Through interagency collaborative efforts, these conditions will be remediated as they are identified.

- DOHMH will inform large-property owners and managers of the need to eliminate mosquito-breeding sites on their property or to properly treat them with larvicides.

- DOHMH will work with the New York City Department of Sanitation to prioritize and enhance the enforcement of lot cleaning and to ensure an aggressive tire disposal program. Abandoned lots are particularly conducive to mosquito breeding, and in areas where WN virus has already been detected these lots will be targeted for remediation.

- DOHMH will work with the New York City Department of Buildings to develop and implement a protocol requiring all City's demolition and excavation contractors to larvicide when their activities result in significant sources of mosquito breeding.

- The public will be asked to help eliminate mosquito-breeding sites and to report standing water using the City's toll-free Citizen Service Center Line (311) and the DOHMH Web site (www.nyc.gov/health/mosquito).

- From April 1st through October 31st, OVSC investigates all public complaints of standing water. OVSC will monitor the reported breeding sites, send letters to property owners asking them to address the problem, conduct on-site inspections of the more egregious conditions, make referrals to appropriate agencies for abatement, and, if necessary, issue notices of violation.

- DOHMH will use VectoLex® (*Bacillus sphaericus*), VectoBac®/AquaBac®/Submit Bti Briquets® (*B. thuringiensis* var. *israelensis*, Bti), and VectoMax® larvicides (mixture of *B. sphaericus* and *Bti)*. Pesticide resistant management is a core component of this comprehensive mosquito control plan. DOHMH will continue monitoring local mosquito populations for resistance development for all above mentioned larvicides.

- Use of methoprene (Altosid®) and Bti-methoprene combination products (VectoPrime®) may be used in specific situations. Methoprene is an insect growth regulator used to control many types of insects. This chemical quickly breaks down in water and sunlight and does not persist in the soil. The U.S. Environmental Protection Agency has placed methoprene into the category of "least toxic" with regard to humans. Additionally, DOHMH will continue to explore other registered products that may increase the effectiveness of the larviciding program.

- Beginning in May, bacterial larvicides will be applied at wastewater treatment plants, parks, and other surface waters, if larval breeding is present. Applications will be made by hand, backpack, or aerially via helicopter. Larvicides will continue to be applied as needed throughout the mosquito-breeding season.

- Beginning in May/June, bacterial larvicides will be applied to sewers and to more than 150,000 catch basins citywide. Applications will continue, based upon larval surveillance findings, as needed throughout the mosquito-breeding season.

- OVSC staff will intensify larval surveillance and control once WN virus activity or high abundance of *Ae. albopictus* (the potential vector of Zika virus) is identified in an area. Targeted neighborhoods will have an expanded public outreach regarding breeding site elimination and personal protection; community-specific media materials will also be distributed.

- DOHMH will work with the Parks Department and other partners to provide mosquito control in green areas (e.g., parks, cemeteries, and golf courses), especially in areas where infected mosquitoes are found.

- DOHMH will provide occupational safety and health training to all employees involved in mosquito surveillance and control operations. Additionally, DOHMH will require that all employees from contracted vendors be provided with similar training as well as appropriate personal protective equipment.

- If local transmission of a vector-borne disease occurs, DOHMH will assist

residential property owners in identifying and remediating standing water on their property.

For residents conserving rainwater, OVSC will recommend covering the barrels or other water holding containers with a tight-fitting lid or very fine mesh screen. Also, bacterial larvicides containing *Bti* can safely be placed in the barrels for mosquito larvae control.

ADULT MOSQUITO CONTROL

Objective

To reduce the abundance of WN virus infected adult mosquitoes in targeted areas through the judicious use of pesticides

Background

Comprehensive vector and human surveillance data collected during the last seventeen seasons has allowed DOHMH to develop a more sensitive protocol for determining and monitoring the level of WN virus activity and the risk for human disease throughout the City.

DOHMH practices Integrated Pest Management (IPM) for managing mosquito populations in the City. Adulticiding operations are only performed as a last resort when surveillance data indicate a significant risk of disease transmission to humans. During the last sixteen years, only Anvil 10+10™, containing sumithrin (d-phenothrin), was used for adult mosquito control. This product is a synthetic pyrethroid that has been used for more than 40 years. During 2016 - 2018, DOHMH used Duet™ in addition to Anvil 10+10™. The main difference between Duet™ and Anvil 10+10™, is that Duet™ contains prallethrin, an agitating agent in addition to Sumithrin. Prallethrin is effective in targeting day biting mosquitoes like *Aedes albopictus*. Beginning 2018, DOHMH has also used a third pyrethroid product called as DeltaGard®. Anvil 10+10™, Duet™ and DeltaGard® provide a rapid knockdown of adult mosquitoes. DOHMH may use other pyrethroid based pesticides as well.

Sumithrin, the active ingredient of both Anvil and Duet, and deltamethrin, the active ingredient of DeltaGard, exhibits low mammalian toxicity, degrades rapidly in sunlight, provides little or no residual activity, and does not accumulate in the environment. These products are applied at very small quantities per acre (0.00045-0.0036 pounds/acre) and are referred to as ultra-low volume (ULV) application. ULV-delivery techniques minimize environmental impacts while effectively managing adult mosquito populations. All DOHMH adulticiding events are monitored by City, State and Federal officials to ensure compliance with applicable laws and regulations.

DOHMH performs adulticiding only as a last resort, when established criteria for adulticiding have been met. DOHMH uses pesticide only when it is necessary and only when a spray event can reduce the disease transmission risk. Mosquito density and distribution, mosquito species, persistence of West Nile virus (or Zika virus activity in case of its local transmission), weather, time of year, and proximity to human populations are all carefully considered in determining the necessity for adult mosquito control in a particular area.

The decision to adulticide is based on data obtained from mosquito surveillance and testing, and established and successful algorithms/decision trees. OVSC uses different criteria based on disease risk. For WN virus there are two different algorithms depending on whether or

not a human WN virus case is involved. The Positive Mosquito Pool Algorithm is driven by 1) the presence of WN virus in mosquitoes, 2) the persistence (ongoing activity) of WN virus in locations where positive mosquitoes were found, 3) the competency of infected mosquito species in transmitting WN virus, 4) the propensity of WN virus positive mosquito to bite humans and 5) the population density in areas where WN virus positive mosquitoes were trapped. The Positive Human Case Algorithm is driven by 1) the presence of human case(s) in an area and 2) the evidence of local transmission of the virus [presence of positive WN virus mosquito(es) in area near the human case. In the event that DOHMH identifies a Zika virus-positive mosquito pool or locally-transmitted human case, adulticide will be applied in the affected area.

DOHMH will utilize its surveillance data to assess the risk of an outbreak of above mentioned mosquito borne diseases. DOHMH only applies pesticides in a limited and targeted area to control adult mosquitoes which is determined by considering habitat; time of year; weather conditions; the intensity of viral activity; the distribution, density, species, age and infection rate of the vector population; and the density and proximity of human populations.

Planned Activities

DOHMH will conduct adulticiding activities when surveillance data implicate a serious risk for human disease

Outline of Control Activities Based on West Nile Virus Presence

Level 1 – No Pathogen Detection

DOHMH *Response*: Surveillance and control programs continue as outlined in the City's Mosquito Surveillance and Control Plan. Periodic reports or communications are made to the WN virus Steering Committee providing current status of the various surveillance programs. Periodic press releases are issued providing the public with current surveillance results.

Level 2 – Initial or Single Pathogen Detection
Initial or a single detection of mosquito-borne viral pathogens in mosquito populations or avian populations in New York City will result in a move to Level 2 responses.

DOHMH *Response*: OVSC recommendations will be communicated to the WN virus Steering Committee and the DOHMH Commissioner. Upon approval by the Commissioner, a press release will be drafted, notifying the public of the findings. Surveillance programs will continue with the following added activities:

- CDC Light and Gravid Traps will be added to the area of concern if additional surveillance data are required.

- Larval surveillance and enhanced adult trapping will be conducted in affected areas if needed.

- Laboratory testing of mosquito pools will be given priority in primary vectors *Culex pipiens* and *Cx. restuans,* and bridge vector *Cx. salinarius*.

- Data from these additional traps and surveillance measures will aid in determining the extent of pathogen transmission and abundance of mosquito populations and will be used to guide control measures, if applicable.

Level 3 – Continued or Multiple Pathogen Detections

Persistent detection of mosquito-borne pathogens or detection in bridge vector mosquitoes or in non-avian vertebrate populations in New York City will result in a move to Level 3 responses.

DOHMH *Response:* OVSC recommendations will be communicated to the DOHMH Commissioner. Upon approval by the Commissioner, a press release will be drafted, notifying the public of the recent findings. Surveillance programs will continue as noted above. Control measures will be implemented.

- CDC Light and Gravid Traps will be added to the area of concern if additional surveillance data are required.
- Larval surveillance and enhanced adult trapping will be conducted in affected areas if needed.
- Laboratory testing of mosquito pools will be increased in primary and bridge vector species.
- Control measures to be considered:
  - Application of larvicides (including aerial and truck mounted applications) to areas breeding large numbers of mosquitoes
  - Ground application of adulticides to immediate areas of concern
  - Aerial application of adulticides may be considered in the event of an epidemic
  - Recommend the restriction and/or cancellation of outdoor evening activities
  - Recommend the closing of outdoor recreational areas

- DOHMH will consider EPA and NYS DEC registered products for mosquito control that contain the following active ingredients: sumithrin, permethrin, or naled. The City will continually review the available information on the health impact of pesticides. Any products used will be applied in compliance with City, State, and Federal laws and regulations.

- The public will be notified of adulticide schedules in advance, which will allow sufficient time to take any necessary precautions to reduce pesticide exposure. (See Public Education and Community Outreach)

- Hospitals will be notified regarding the adulticiding schedule. Information on the pesticide to be used will be provided to the public, physicians and other health care providers.

- Adult mosquito control will be scheduled when mosquitoes are most active and when weather conditions are conducive to successful application.

- Information will be released at least 24 hours in advance of the scheduled spray event through the media, the DOHMH web site, 311, and pertinent City and community organizations.

- DOHMH will monitor and assess control activities for any potential environmental and health effects through several measures, including pre- and post-spray environmental sampling and addressing pesticide exposure complaints received by DOHMH.

- Depending on surveillance findings and other criteria, DOHMH or its contractor, may apply targeted adulticides in response to community concerns about nuisance mosquitoes in the Rockaways.

SURVEILLANCE OF POTENTIAL ADVERSE HEALTH EFFECTS FROM PESTICIDE EXPOSURE

Objective

To perform passive and syndromic surveillance to monitor for possible exposure to pesticides used to control adult mosquitoes and the potential health sequelae due to such exposure

Background

Since exposure to pesticides has the potential to cause adverse reactions, particularly among those with pesticide sensitivity or underlying health conditions, beginning in 2000, DOHMH took additional care to provide advance notification whenever adulticide applications were to occur. Prior to conducting adult mosquito control activities, information on pesticides was sent to all hospital emergency departments, which included product information on pesticides, Safety Data Sheets (SDS), and other information relevant to identifying possible exposures to pesticides. Each year since 2000, calls to the New York City Poison Control Center (NYC PCC) have been monitored during pesticide spraying and relevant exposures were forwarded to the New York State Pesticide Poisoning Registry (NYS PPR) for review and possible inclusion in the registry. In 2001, active surveillance for pesticide-related health complaints was performed. In this regard, chart reviews were conducted in emergency departments and physicians were randomly surveyed in the affected areas by telephone to determine if any individuals had sought care for symptoms related to possible exposure to adulticides. No cases of individuals reporting to emergency departments or seeking care from their physicians for health complaints related to adulticide exposure were found through these activities. Additional research was conducted to determine whether pesticide applications associated with mosquito control were associated with negative health outcomes. As a recent publication reported, no such associations were found.[1]

Beginning in 2002, syndromic surveillance was adopted as a surveillance tool to identify any possible respiratory symptom related clusters in areas in which a spray action occurred. If such a cluster is identified, DOHMH conducts further review of emergency department data to investigate the possible etiology of that cluster. In addition, the Poison Control Center monitors pesticide-related calls for number and severity that are geographically and temporally associated with spray events.

Planned Activities

- Prior to conducting adult mosquito control activities, information on pesticides and their possible adverse health effects will be sent to all hospital emergency departments, including product information on pesticides and other information relevant to identifying possible exposure to pesticides.

[1] Karpati AM, Perrin MC, Matte T, Leighton J, *et al*. Pesticide Spraying for West Nile Virus Control and Emergency Department Asthma Visits in New York City, 2000. Environ. Health Perspect. 2004 Aug; 112(11): 1183-7.

- Calls received by the New York City Poison Control Center (NYC PCC) will continue to be monitored during pesticide spraying for geographic and spatial associations with spray events. These data will continue to be forwarded to the NYS Pesticide Poisoning Registry for possible follow-up and inclusion in the Registry.

- Syndromic surveillance will also continue to be utilized to identify possible asthma and respiratory illness clusters in the zip codes in which spraying occurs. Statistical and field investigation methods for evaluating spatial and temporal clustering are described in recent publications.

- In the event that a possible respiratory symptom cluster is identified, emergency department chart review will be considered to investigate the possible etiology of that cluster at nearby hospitals.

RESEARCH AND EVALUATION

Objective

To better understand the transmission and overwintering mechanism of mosquito-borne diseases and to assess the effectiveness of DOHMH surveillance, prevention and control methods

Background

One of the most important roles for public health professionals is to assess the potential impact of a disease and to devise safe and effective methods for reducing the risk of such transmission. DOHMH, in collaboration with CDC and NYSDOH, has closely studied the risk factors for infection, morbidity, and mortality from WN virus. However, many questions still remain about how the virus circulates in nature.

In a successful IPM program, constant evaluation is needed to effectively and safely manage mosquitoes. Mosquitoes have a high propensity to develop resistance to pesticides, requiring continued evaluation of the efficacy of all mosquito control activities.

Additional pesticide products have been approved for mosquito control use in NYC by state and federal agencies. DOHMH will continue to assess the health effects of these and any products considered for use for its mosquito control program.

Furthermore, some of the control methods used for managing mosquito populations, especially the application of pesticides for adult mosquitoes, are not without potential negative impact. Alternative control measures lack sufficient efficacy or environmental impact data to allow their wholesale integration into this plan. The environmental impact statement and other research endeavors are important tools used to assess potential adverse health effects associated with pesticide exposure. Additional research in assessing novel control techniques is also an important aspect of an effective mosquito control program for New York City.

Planned Activities

- DOHMH will continue to work closely with Federal, State, and Local partners to conduct research that will identify the most effective predictors of human illness from WN virus and other diseases that can be spread by mosquitoes in New York City, including the analysis of overwintering mosquito populations and the use of predictive disease models.

- DOHMH will continue to refine the New York City-specific phased response for risk categories of mosquito-borne disease outbreaks based on the ongoing analyses of bird, mosquito, mammalian and human surveillance data.

- DOHMH will evaluate emerging methods of surveillance and control.

- DOHMH will research and evaluate the potential public health and environmental

impact of the application of pesticides for adult mosquito control.

- DOHMH will research and evaluate the development of resistance in mosquitoes due to the application of pesticides (microbial larvicides and adulticides).

- DOHMH will test hibernating mosquitoes for WN virus infection to determine their role in the overwintering of WN virus from one season to the next.

- The host seeking activity patterns of mosquitoes will be determined by using collection bottle rotator traps in various habitats such as marsh, urban areas and parks.

- Larval surveillance will be conducted before and after the control activities in the catch basins (storm drain) and natural breeding sites for determining larval control efficacy of the pesticides.

- DOHMH will collect fish mortality data from the Parks Department and take water samples from environmentally sensitive waterbodies before and after adulticiding events to measure the impact of spray events on the environment. The water samples will be tested at the Westchester Water Testing Laboratory. The results of these tests will be shared with NYS DEC and Federal EPA.

APPENDIX A

FREQUENTLY ASKED QUESTIONS ABOUT WEST NILE VIRUS

Background

What Mosquito-Borne Diseases are present in New York City?

West Nile virus is the only locally mosquito transmitted disease known to currently occur in the City.

Do all mosquitoes carry disease?

While there are many different species of mosquitoes, only a small proportion can transmit diseases like West Nile virus.

What is West Nile virus?

West Nile virus is a mosquito-borne virus that can infect humans, birds, horses and other mammals. Outbreaks of West Nile virus have occurred in Africa, Egypt, Israel, Asia, Romania, Russia and France. Before 1999, West Nile virus had never before been found in the Western Hemisphere. West Nile virus first appeared in North America in New York City in 1999. The virus was most likely introduced by an infected bird or mosquito that was imported from a country where the virus is common. Since 1999, the virus has spread across the continental United States. Visit www.cdc.gov for more information on West Nile virus nationally.

Signs and Symptoms

What are the symptoms of West Nile virus?

Most people who are infected with West Nile virus either have no symptoms (80%) or experience a mild or moderate illness (20%) with symptoms such as fever, headache, fatigue, or body aches before fully recovering. Some persons may also develop a rash or swollen lymph glands. Symptoms can last for as short as a few days, though even healthy people have become sick for several weeks.

While rare (< 1%), some individuals, particularly persons 60 years of age and older, can develop serious disease from West Nile virus infection. Also known as West Nile neuroinvasive disease, illness may include encephalitis (inflammation of the brain), meningitis (inflammation of the membrane around the brain and spinal cord), or acute flaccid paralysis (a polio-like syndrome in which muscles become very weak or paralyzed). Symptoms of this more severe form of disease may include headache, high fever, stiff neck, nausea and vomiting, confusion, coma, tremors, convulsions, muscle weakness and/or paralysis. At its most serious, West Nile virus can cause permanent neurological damage and death.

Who is most at risk for getting severe West Nile virus disease after being bitten by an infected mosquito?

Anyone who is infected can potentially develop severe West Nile virus disease (e.g. encephalitis, meningitis, or acute flaccid paralysis). However, persons older than 60 have the highest risk of becoming severely ill, and there is increasing evidence that immunocompromised persons (e.g., people who are taking immunosuppressive medications such as prednisone, or people who have received organ transplants) are at higher risk for severe West Nile virus disease too.

What proportion of people die when infected with West Nile virus?

Fewer than 1% of people infected with West Nile virus develop encephalitis, and among those hospitalized with West Nile encephalitis, the case fatality rate ranges from 10% to 15%. Therefore, fewer than 1 in 1,000 people infected with West Nile virus die. Individuals over the age of 60 are at greatest risk for the severe complications of West Nile virus.

Transmission

How is West Nile virus spread?

West Nile virus is predominantly spread to humans by the bite of an infected mosquito. In 2002 other methods of human transmission were discovered but appear to be rare. It has now been shown that West Nile virus can be transmitted to humans who receive transfusions of infected blood or blood products, or who receive infected organs through transplantation. Currently, routine testing of donated blood products is conducted to reduce this risk of transmission. Also, in 2002 there was one case of transmission from a pregnant woman to her fetus, and one probable case of mother-to-baby transmission through breast milk. Additionally, two laboratory workers were accidentally infected following injuries while handling infected birds. You cannot get West Nile virus from another person (with the exception of blood products and organ donations from an infected person). West Nile virus is NOT spread by casual contact such as touching, kissing, or caring for someone who is infected.

How long does it take to get sick after a bite from an infected mosquito?

If illness does occur, symptoms generally appear between 3 to 15 days of being bitten by an infected mosquito.

Can I get West Nile virus directly from birds?

In 2002, CDC reported two human cases of West Nile virus in laboratory workers who became infected after injuries while handling infected dead birds. It is extremely unlikely that members of the general public would be exposed to West Nile virus in this manner. However, as always, when handling a dead bird or animal for disposal, use gloves to carefully place the bird in double-plastic bags and then place in the outdoor trash.

Besides mosquitoes, can I get West Nile virus directly from other insects or ticks?

Infected mosquitoes are the primary source of West Nile virus and caused the recent outbreaks in the United States. Although several types of ticks in Africa and Europe have been found to be infected with West Nile virus, there is no evidence that ticks or other insects in this country are able to transmit the virus.

Children and Pregnant Women

Are children and infants at greater risk for severe West Nile virus disease?

Children and infants are not at greater risk than other individuals for becoming infected with West Nile virus but they can potentially develop severe West Nile virus disease. In the years from 1999-2008, 589 children under age 20 years in the US were reported with West Nile encephalitis, meningitis or acute flaccid paralysis. This is 5% of all reported cases of severe West Nile virus disease for these years.

If I am pregnant and get infected with West Nile virus, can it affect my fetus?

Maybe. It is unknown how often transmission occurs during pregnancy and it is difficult to predict the effects of infection on every baby. In 2002 there was one case of transmission of West Nile virus from mother to fetus during pregnancy. The newborn was infected with West Nile virus at birth and had severe neurological problems, including abnormalities of the brain and retinas. It is possible that West Nile virus caused these abnormalities in the baby; however, it is not proven. The Centers for Disease Control and Prevention (CDC) studied outcomes of about 70 pregnant women who were infected with West Nile virus in 2003 or 2004. Most of the infants born to these mothers seemed normal. Three infants had West Nile virus infection that could have been acquired from the mother during pregnancy. Three different infants in this study were born with malformations that could have been caused by the mother's West Nile virus infection, but there is no evidence that West Nile virus was the cause of the deformities.

Can West Nile virus be transmitted through breast milk?

Possibly. It appears that West Nile virus may be transmitted to infants through breast milk. In 2002, a woman developed encephalitis due to West Nile virus acquired through a blood transfusion she received shortly after giving birth. Laboratory analysis showed evidence of West Nile virus in breast milk collected from the mother soon after she became ill. She had been breastfeeding her infant and approximately 3-4 weeks after birth the infant tested positive for the West Nile virus. Because of the infant's minimal outdoor exposure, it is unlikely that the infection was transmitted by a mosquito – it is more likely that the infant became infected through the mother's breast milk. However the infant had no symptoms of West Nile virus and remained healthy.

The health benefits of breastfeeding have been well established. The risk for West Nile virus transmission through breastfeeding is not fully understood, and the new findings from 2002 do not change current breastfeeding recommendations.

If you have confirmed West Nile virus infection, decisions regarding continuing breastfeeding should be made in consultation with both your doctor and your baby's doctor.

If I am pregnant or breastfeeding, should I be tested for West Nile virus?

There is no need to be tested for West Nile virus if you are pregnant or breastfeeding unless you are ill during West Nile season (in New York City this means June through October). Pregnant women who develop an unexplained fever or become ill with other symptoms compatible with possible West Nile virus infection such as fever, headaches, stiff neck, nausea and vomiting, confusion, muscle weakness, or your eyes become sensitive to light,

you should see a doctor immediately.

Should parents spray insect repellent on their children before they go to school?

Children who attend school, camp or go on trips outdoors during the daytime are at low risk for mosquito bites. However, mosquitoes can still be active during the day in areas where there are weeds, tall grass, bushes or areas with known high mosquito activity. Precautions should be taken to protect your child from mosquito bites if a child will be in or near areas where mosquitoes are active, or if playing outside at dusk, night time or at dawn. For more information about repellents and children, go to the Repellents (www1.nyc.gov/site/doh/health/health-topics/insect-repellent-safety.page) and Personal Protective Measures (www1.nyc.gov/site/doh/health/health-topics/west-nile-virus-precautions.page) section.

Testing and Treatment

How is West Nile virus treated?

There is no specific treatment for West Nile virus. Most people who become infected will get better on their own. In more severe cases, intensive supportive therapy is indicated, i.e., hospitalization, intravenous (IV) fluids and nutrition, airway management, ventilatory support (ventilator) if needed, prevention of secondary infections and proper nursing care.

Although there is currently no specific therapy proven to be effective for treating West Nile neuroinvasive disease, there are a couple of clinical trials underway. Not every patient with West Nile infection is eligible for this treatment. Patients or their families who want more information about these experimental treatments should ask their medical providers about them. Medical providers may contact the Bureau of Communicable Disease at the New York City Department of Health and Mental Hygiene for more information.

What should I do if I think I have West Nile virus?

People with mild or moderate symptoms should recover completely, although some symptoms may last for weeks, and do not usually require any specific medication. However, if you develop symptoms such as fever, headaches, stiff neck, confusion, muscle weakness, or your eyes become sensitive to light, you should consult your doctor and be tested for West Nile virus.

If I get bitten by a mosquito, should I be tested for West Nile virus?

Most mosquitoes are not infected with West Nile virus and illnesses related to mosquito bites are uncommon. There is no need to be tested for West Nile virus unless the person bitten is ill and has symptoms suggesting possible West Nile virus infection. If after someone in your family gets bitten they develop symptoms such as fever, headaches, stiff neck, confusion, muscle weakness, or your eyes become sensitive to light, you should consult your doctor about getting them tested.

Is there a vaccine for West Nile virus?

There is currently no human vaccine for West Nile virus, but several companies are working towards developing one. There are West Nile virus vaccines that have been approved for use in horses.

Mosquito Control in New York City

What is the City doing to address the problem of West Nile virus?

New York City is working to reduce the risk of West Nile virus infection. The main goal is to decrease the number of adult mosquitoes by eliminating breeding sites wherever possible and applying larvicides (to kill the immature larval form of the mosquito) to areas of standing water that cannot be drained completely. The City also regularly tests mosquitoes for West Nile virus throughout the spring and summer.

Is the City planning to spray pesticides?

New York City may spray pesticides to target adult mosquitoes if there is a risk to human health from West Nile virus. Spraying will be concentrated in areas most at risk for disease occurrence and will be conducted by experienced and licensed applicators who are required to follow New York State Department of Environmental Conservation (NYSDEC) and EPA requirements. The City is hopeful that with an early and aggressive campaign against mosquito breeding areas, the need for the spraying of pesticides will be reduced.

At what time of day will the city be spraying?

New York City will only spray for mosquito control in the evenings or preschool hours of the morning.

Will the public be notified in advance about spraying activities?

Residents can learn about adulticiding schedules in advance through public service announcements, the media, the City's website (nyc.gov/health/wnv, spray schedule at www1.nyc.gov/site/doh/health/health-topics/insect-repellent-safety.page), or by calling 311, the City's Information Line. DOHMH will provide notification at least 24 hours prior to a spray event.

Do pesticides sprayed to eliminate adult mosquitoes pose health risks to people and pets?

In the amounts of pesticides used, following guidelines set by the EPA and the NYSDEC, health risks to people and pets are relatively low. However, some people may be more sensitive to pesticides and may experience short-term eye or throat irritation or a rash. To reduce your chance of exposure, follow the suggestions below. Anyone experiencing adverse reactions to pesticides should seek medical care or call 311 or the NYC Poison Control Center at (212) POISONS (764-7667) or 1-800-222-1222.

If the City sprays pesticides in an area where I am, what should I do during the spraying?

If pesticide spraying occurs, DOHMH recommends that all individuals take the following precautions to avoid direct exposure to pesticides and reduce the risk of reactions:

- Whenever possible, stay indoors during spraying.
- Some individuals are sensitive to pesticides. Persons with asthma or other respiratory conditions are encouraged to stay inside during spraying since there is a possibility that spraying could worsen these conditions.
- Air conditioners may remain on. But if you wish to reduce the possibility of indoor

exposure to pesticides, set the air conditioner vent to the closed position, or choose the recirculate function.
- Wash skin and clothing exposed to pesticides with soap and water.
- Always wash your produce thoroughly with water before cooking or eating.

Anyone who has a bad reaction to pesticides should seek medical care or call 311 or the NYC Poison Control Center at (212) POISONS (212-764-7667) or 1-800-222-1222.

Dogs and Cats

Can West Nile virus cause illness in dogs or cats?

West Nile virus has been confirmed in some domestic animals, including pet birds, dogs and cats. A study done in Queens in 1999 showed that 5% to 11% of dogs tested had been exposed to West Nile virus, though none were clinically ill. Infected cats may exhibit mild, nonspecific symptoms during the first week after infection--for the most part only showing a slight fever and slight lethargy. It is important to remember that pets with neurologic disease should be first evaluated for other more likely causes of illness, including rabies.

Can infected dogs or cats be carriers and transmitters of West Nile virus to humans?

West Nile virus is predominantly transmitted by infected mosquitoes. There is no evidence that dogs and cats can transmit West Nile virus to humans. Veterinarians should take normal infection control precautions when caring for animals suspected of having West Nile virus or any other viral infection.

How do dogs or cats become infected with West Nile virus?

Dogs and cats become infected the same way humans become infected: by the bite of an infected mosquito.

Can a dog or cat infected with West Nile virus infect other dogs or cats?

There is no documented evidence that West Nile virus is transmitted between dogs and cats.

What should I do if I think my dog, cat, or pet might have West Nile virus?

While dogs and cats do not appear to suffer clinical illness from West Nile virus, if you think your pet is ill, you should see your veterinarian promptly. Pets can develop neurologic diseases from many other causes, and these should be ruled out before testing for West Nile virus is considered.

Should a dog or cat infected with West Nile virus be euthanized?

As animals infected with West Nile virus do not transmit the virus to people or other animals, there is no reason to euthanize an infected animal. Treatment would be supportive and consistent with standard veterinary practices for animals infected with any viral agent.

Can I use insect repellent on my pets?

DEET-based repellents, which are recommended for humans, are not approved for veterinary use (largely because animals tend to ingest them by licking.) Talk with your veterinarian for advice about the appropriate product for use on your pet.

Blood and Organ Donation

If a person was diagnosed with West Nile virus, can they still donate blood?

A person can donate blood once the person has fully recovered from West Nile virus and there is no evidence to suggest that the virus is still in their blood. However, people who have recently been diagnosed with West Nile virus or who have had a recent illness with fever should not donate blood, other body fluids or organs for at least one month following their illness.

Can I get West Nile virus from donating blood?

It is not possible for a person to get West Nile virus or any infectious disease from giving blood. If you have more questions about West Nile virus and the blood supply, please contact the New York Blood Center at 1-800-688-0900.

More Information

If I travel outside New York City, do I need to worry about West Nile virus?

Yes. West Nile virus has spread throughout the United States and is present in other parts of the world as well. In some areas of the country, particularly the south and the west, the West Nile virus transmission season lasts longer. People can become infected with West Nile virus early in the spring or as late in the year as November or December. So when you travel, especially during the spring, summer and fall, you should check with the local health department wherever you go to see if West Nile virus, or any other arboviruses, are present. If yes, then you should take proper precautions to avoid mosquito bites.

Should I report dead birds to the Department of Health and Mental Hygiene?

No, unless you are reporting a group of 10 or more dead birds of any species, or a group of 3 or more dead waterbirds. The Health Department will no longer take reports of individual dead birds to monitor for West Nile virus. These tests had limited value as an early warning system for the virus. The Department will continue to take reports of groups of dead birds (10 or more of any species or 3 or more waterbirds). To report these clusters, call 311. If you need to dispose of a dead bird, use disposable rubber gloves to carefully place it in a double plastic bag, and then put the bag in the outdoor trash. Wash your hands with warm soapy water afterwards.

For more information about West Nile virus, call the New York City Citizen Service Center, 24 hours a day, seven days a week, by dialing 311 or check the DOHMH Website at nyc.gov/health/westnile)

GLOSSARY

adulticide	a type of pesticide used to kill adult mosquitoes
Aedes albopictus	a day biting species of mosquitoes
Aedes sollicitans	*See Ochlerotatus sollicitans*
Altosid®	brand name of methoprene, a type of larvicide
arbovirus	shortened term for arthropod-borne virus, a virus that is carried by arthropods
arthropod	a group of an animal that does not have a backbone and have jointed walking appendages, such as insects, spiders and lobsters
Bacillus sphaericus	a bacterium; type of biological pesticide used to control mosquito larvae in water (mosquito larvae die after ingesting this bacterium)
Bacillus thuringiensis var. *israelensis* (Bti)	a bacterium; type of biological pesticide used to control mosquito larvae in water (mosquito larvae die after ingesting this bacterium); bacteria found in Mosquito Dunks®
bridge vector	an arthropod (in this case, a specific species of mosquito) that serves as a main transmission of virus between the reservoir (birds) and humans.
catch basins	grates seen at street corners and in other properties for water runoff
Culex pipiens	a species of mosquito, the primary vector for West Nile virus, commonly found in urban areas; breeds in fresh, but stagnant water, such as backyard containers and storm drains
DEET	DEET (chemical name, N,N-diethyl-meta-toluamide) is the active ingredient in many insect repellent products
DeltaGard®	a pyrethroid-based pesticide for adult mosquito control
Deltamethrin	an insecticide belonging to the pyrethroid family
Duet®	a pyrethroid-based pesticide for adult mosquito control
Eastern Equine Encephalitis (EEE)	mosquito-borne viral disease that causes inflammation of the brain; similar to West Nile

encephalitis	inflammation of the brain, which can be caused by numerous viruses and bacteria, including West Nile virus
Environmental Impact Statement (EIS)	a document that describes the impact on the environment from a proposed action (in this case, the application of pesticides to control adult mosquitoes).
gravid traps	mosquito traps designed to attract pregnant female mosquitoes
Guillain-Barré syndrome	an uncommon sickness of the nervous system in which a person's own immune system damages the nerve cells, causing muscle weakness, and sometimes, paralysis.
Interactive Voice System	an automated telephone system by which information can be accessed by choosing from a set of options
IR3535	IR3535 (3-[N-Butyl-N-acetyl]-aminopropionic acid, ethyl ester) is the active ingredient in many insect repellent products
larvae	immature mosquitoes that live in water; stage which hatches from the egg, prior to adult stage
larvicide	a type of pesticide used to control immature or larval mosquitoes
light traps	mosquito traps outfitted with a light to attract mosquitoes
meningitis	inflammation of the lining of the brain and spinal cord that can be caused by a virus or bacteria
methoprene	a type of (synthetic) insect growth regulator used to control larval mosquitoes; it prevents mosquito larvae from emerging and developing into adult mosquitoes
mosquito breeding site	a location where mosquitoes lay eggs, usually in stagnant water with organic material
mosquito pools	a group of mosquitoes of the same species, collected in given area and combined at the laboratory for testing for the presence of West Nile and related viruses
naled	an organophosphate pesticide used to control adult mosquitoes
neurology	the study of the nervous system and its disorders
Ochlerotatus sollicitans	species of mosquito that breeds in salt marshes

outbreak	an unexpected increase in frequency or distribution of a disease
permethrin	a synthetic pyrethroid pesticide used to control adult mosquitoes; active ingredient in the product Biomist®
pesticide	substance used to kill pests such as insects, mice and rats; an insecticide is a form of pesticide
picaridin	(chemical name, 1-Piperidinecarboxylic acid, 2-(2-hydroxyethyl)- 1-methylpropylester) is the active ingredient in many insect repellent products
piperonyl butoxide	An additive to pyrethroid pesticides that improves the effectiveness of the active ingredient
salt marsh	areas of vegetation in bodies of salt water that may support the breeding of certain types of mosquitoes such as *Ochlerotatus sollicitans*; example of salt marshes is Jamaica Bay.
sentinel	an early warning system, in this case, for the presence of virus (e. g. , sentinel chickens)
serologic	of, or relating to, serum
source reduction	the removal or reduction of larval mosquito habitats
St. Louis encephalitis (SLE)	mosquito-borne viral disease that causes inflammation of the brain; very similar to West Nile virus
sumithrin	a synthetic pyrethroid pesticide used to control adult mosquitoes; active ingredient in the product Anvil 10+10®
VectoBac	brand name for the larvicide *Bacillus thuringiensis* var. *israelensis* (*Bti*)
VectoLex	brand name for the larvicide *Bacillus sphaericus*
VectoMax	brand name for the larvicide based on mixture of *Bacillus sphaericus and B. thuringiensis* var. *israelensis* (*Bti*)
vector	an organism (an insect in most cases) capable of carrying and transmitting a disease-causing agent from one host to another
viral encephalitis	inflammation of the brain caused by a virus, such as West Nile virus
Zika virus	a mosquito-borne flavivirus that was first identified in Uganda in 1947. In October 2015, Brazil reported microcephaly in infants of pregnant women infected with Zika virus.

Suggested citation:

Bajwa W, Slavinski S, Shah Z, and Zhou L. 2019. Comprehensive Mosquito Surveillance and Control Plan. New York City Department of Health and Mental Hygiene, New York, NY. p. 43.