

**WEST NILE VIRUS
PREPAREDNESS AND
PREVENTION PLAN
2007**

June 25, 2007

Public Health Division
Ministry of Health and Long-Term Care
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Preface

This following document is the West Nile Virus - Preparedness and Prevention Plan for Ontario – 2007, a technical reference document for Ontario’s 36 Health Units to assist with the implementation of the Control of West Nile Virus Regulation – O.R. 199/03), made under the *Health Protection and Promotion Act*. It is referred to in this document as ‘the Plan’. The material content in the ‘Plan’ incorporates the cumulative experience of public health with vector borne diseases and their control across North America with relevance to Ontario’s topography, climate, vector species and vast natural resources, with particular emphasis on our ongoing communication with the public Health Units (HUs) of Ontario.

Risk Assessment

Under the Control of West Nile Virus Regulation (see Appendix V), the local Medical Officer of Health (MOH) is required to conduct a risk assessment of the conditions pertaining to WNV in the Health Unit. This risk assessment will identify the relative risk of human infection from WNV using surveillance information based upon dead birds, mosquito information, equine infections along with any human cases, and may include a number of other relevant information. Completion of the risk assessment in accordance with the Regulation will offer guidance to the appropriate WNV control activities for the Medical Officer of Health (MOH), and if needed, provides a review of appropriate vector (mosquito) control activities (i.e. larval/adult mosquito control measures) and their effective application. Further, the Regulation requires the local municipality to which the risk assessment applies to undertake those measures necessary for vector and disease control when directed to do so by the Medical Officer of Health.

In addition, under the Control of West Nile Virus Regulation, the Medical Officer of Health is also required to maintain a means to record, investigate, and report any confirmed or likely adverse or unintended human health effects attributed to mosquito control actions, and to report any non-human environmental adverse effects that he/she knows about to the Ministry of the Environment and/or other relevant local or provincial authorities.

Acknowledgements

This 2007 document, the next in the annual series, was prepared by the Vector-Borne Disease Unit (VBDU) of the Public Health Division, Infectious Diseases Branch for the Ontario Ministry of Health and Long-Term Care (MOHLTC) with essential input and assistance from many contributors since 2001, including:

- Ontario Ministry of Health and Long-Term Care (MOHLTC)
 - Communications and Information Branch
 - Laboratories Branch (CPHL)
- Ontario Ministry of the Environment (MOE)
 - Standards Development Branch, Pesticides Section
- Ontario Ministry of Agriculture, Food and Rural Affairs (OMAFRA);
 - Veterinary Science Unit, Livestock Technology Branch
- Ontario Ministry of Natural Resources (MNR)
 - Forest Management Branch
- Ontario Realty Corporation (ORC)
- Ontario Ministry of Transportation (MTO)
- Canadian Blood Services (CBS)
- Health Canada
 - First Nations and Inuit Health Branch (FNIHB)
- Public Health Agency of Canada (PHAC -formerly Health Canada)
 - National Microbiology Laboratory (NML), (formerly Health Canada, National Microbiology Laboratory (NML)
 - Centre for Infectious Disease Prevention and Control
- Canadian Cooperative Wildlife Health Centre (CCWHC)
- University of Guelph
- Brock University

The Public Health Division is also appreciative of the ongoing advice from the federal-provincial *National Steering Committee for West Nile Virus*^{*} and its subcommittees on mosquito surveillance and control and on human surveillance chaired by the Public Health Agency of Canada (PHAC).

The Ministry of Health and Long-Term Care would also like to thank the 36 Public Health Units of Ontario for their work over the past years, and their input into the 2007 West Nile Virus Preparedness and Prevention Plan.

Editorial Note:

Commencing with the 2005 Plan, the Ministry of Health and Long-Term Care, when using the shortened three letter form of 'West Nile virus', will utilize 'WNV'. Previously, the common practice was to use "WNV" as the shortened format.

^{*} The *National Steering Committee for West Nile Virus* is the scientific body through which Canada's human case definition for WNV is reviewed and updated.

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Executive Summary

Public Health Preparedness and Prevention Plan - “The Plan” An Overview

This West Nile virus (WNV) planning resource reference document for 2007 builds on the experience Ontario’s public health system had with West Nile virus since 2000. The document incorporates new findings over the same period, and represents the Ontario field guide to the work for 2007. The Plan also is in conformity with the Municipal Mosquito Control Guidelines of Health Canada, Centre for Infectious Disease Prevention and Control (as revised to August 11, 2004). The Guidelines for Surveillance, Prevention and Control (3rd Revision – 2003) published by the Centers for Disease Control and Prevention (CDC), Atlanta, was also consulted for relevant information toward Ontario’s Plan.

The planning resource document is again designed to provide the planning basis for a provincial approach to the preventing and controlling of West Nile virus by the 36 Public Health Units which provide the first line of public health protection in Ontario, along with our major ministerial partners in Ontario (Ministry of the Environment; Ministry of Natural Resources; Ontario Realty Corporation; Ontario Ministry of Agriculture, Food and Rural Affairs and the Ministry of Transportation).

The implementation of the Plan is premised upon the local Health Units undertaking a risk assessment within their jurisdiction taking into consideration all relevant factors to inform decisions involving appropriate actions as required by the Control of West Nile Virus Regulation.

Public Health Roles in Ontario

Health Units

Health Unit responsibilities with regard to infectious diseases are set out in the Mandatory Health Programs and Services Guidelines (excerpt in Appendix IV) and in the HPPA and its Regulations.

Health Units are to carry out risk assessments for WNV within their respective jurisdictions under the Control of West Nile Virus Regulation, and take those measures deemed necessary to prepare for, prevent or mitigate the risk if possible, of contracting of WNV illness within their communities. Each Health Unit is to maintain a regular communication link with their public to ensure that current information on WNV within the Health Unit is widely shared.

Health Units are also responsible for the collection and submission to the Canadian Cooperative Wildlife Health Centre (CCWHC) and their mosquito service providers of

avian and mosquito specimens for laboratory analysis, and those measures required to record the incidence of sample collection and disease reporting to permit surveillance recording and mapping of the disease in Ontario.

In addition, the local Health Units investigate reported WNV-positive human cases and appropriately record their details for analysis, communicate relevant blood-donor or organ-donor information to the Canadian Blood Services, and convey the results of their investigations of WNV cases through the Integrated Public Health Information System (iPHIS) reporting tool.

Ministry of Health and Long-Term Care

The MOHLTC role is to support the Health Units in their work through the co-ordination and cost-sharing of WNV-related work in Ontario. The MOHLTC also provides logistical support through the direct funding of bird surveillance shipping costs, the provision of all mosquito traps as well as the shared funding of mosquito testing services based upon the submissions in 2004, 2005, and 2006 or as negotiated with the respective MOH.

Further, the MOHLTC will provide an ongoing public communication and information program to minimize WNV infections in the province through maximizing public knowledge of the disease and its control, and coordinating this communication work with the Health Units. The MOHLTC will also make available the appropriate data on WNV surveillance on its public website.

In addition, the MOHLTC will provide provincial data analysis and the Health Unit data analyses based upon the information provided by the Health Units following their investigation of WNV case reports and the results of bird and mosquito surveillance. The MOHLTC will also maintain regular communication links with the Public Health Agency of Canada and international contacts respecting WNV matters, as well as providing support for selected WNV prevention or control initiatives which may be proposed from time to time, and share the information obtained with the Health Units. The MOHLTC also maintains annual up-dated liaison with the Ontario Medical Association to ensure access to current WNV information for health practitioners throughout the province.

The MOHLTC is a continuing consultant to the Health Units for all matters related to WNV preparedness, prevention and control.

Public Education, Risk Communication and Community Outreach

Public education on personal protection, together with source reduction measures remain the primary focus of public intervention by the MOHLTC, and the Province's Health Units will again be provided with materials produced by the Ministry's Communications and Information Branch.

This material will focus on the use of mosquito repellents and protective clothing to avoid man-vector contact, and on eliminating vector (mosquito) development sites around the home and cottage.

Host (Bird) Surveillance

The Canadian Cooperative Wildlife Health Centre (CCWHC) will begin regular receipt of sample dead birds from southern Ontario as of May 14, 2007 expanding into northern Ontario effective May 28, 2007. Submitted birds (Crow, Blue Jay and Raven) will be screened with the VecTest™ technique. Positive results will be confirmed by polymerase chain reaction (PCR) testing. For 2007, WNV-avian testing results will be available again through a direct MOHLTC link to the Public Health Agency of Canada (PHAC) website at www.phac-aspc.gc.ca/wnv-vwn/index.html

Together with Ontario and the other provinces and territories, both Health Canada (HC) and the Public Health Agency of Canada support the CCWHC and its programming. Additionally, the MOHLTC offsets the shipping costs involved in sending bird samples from the Health Unit to the CCWHC in Guelph, Ontario through an annual grant.

Human Surveillance

WNV illness is a reportable disease under Ontario Regulation 559/91, made under the *Health Protection and Promotion Act*, effective May 1, 2003. For 2007 the Health Units will continue to enter in human case data using the Integrated Public Health Information System (iPHIS). The WNV Illness case definition has been reviewed annually since 2001 by the National Steering Committee, Human sub-group on West Nile Virus [Appendix I (a)].

Provisions to protect Canada's blood/donated organ supply are in place through prompt notification by the local Health Unit to the Canadian Blood Services (CBS) and Trillium Gift-of-Life of any positive human results with blood/organ histories. In turn, CBS will be contacting Health Units and the MOHLTC about positive findings they identify amongst asymptomatic donors.

Special Protocols for Information Sharing between Health Units and Associated Agencies

Protocols have been developed and are available in Appendix I (b), (c) and (d). These include reporting forms to be used when providing information from:

1. Health Units to the Central Public Health Laboratory [Appendix I (b)]
2. Health Units to the Canadian Blood Services (CBS) [Appendix I (c)]
3. Health Units to Trillium Gift-of-Life for human organ donations [Appendix I (d)].

WNV Human Case Reporting on MOHLTC Website

For the purposes of recording human WNV illness cases on the public website, the total number of human cases will be reported. These will not be divided into “probable” or “confirmed” categories.

Vector (Mosquito) Surveillance

Mosquito surveillance remains the mainstay in the prevention and control of WNV. Ontario’s program for vector (mosquito) surveillance is focused toward the prevention and the control of WNV and to some limited extent, the assessing of the human risk potential for Eastern Equine Encephalitis (EEE).

The vector surveillance is based upon adult mosquito trapping from spring through fall. Trapped mosquitoes are sorted, identified to species level and enumerated by species which are then placed into ‘pools’[†]. These may be further tested at the request of the local MOH to determine the WNV status. The status must be determined through the “Gold Standard” which is Real Time Reverse Transcriptase Polymerase Chain Reaction test (RT-PCR).

Following active mosquito trapping research and surveillance reports from 2001 through 2005 across the Province, it has now been established that more than 20 species or groups of species have tested positive for WNV. These species continue to be the suggested focus of the 2006 viral testing.

The purpose of vector (mosquito) surveillance is to help determine the immediacy of the risk from contracting WNV in the Health Unit. This is crucial information required by the medical officer of health for each local health unit for purposes of decision making in the prevention and control of WNV illness and to evaluate the local program effectiveness.

Secondary Mosquito Surveillance

Ontario has incorporated a secondary adult mosquito EEE surveillance program focused on *Culiseta melanura*, the major vector of Eastern Equine Encephalitis (EEE). Ontario has never reported a human case of EEE.

While no EEE equine cases were reported for 2005 or 2006, 11 equine cases of EEE were reported in 2003, and one equine case for 2004. EEE remains an important mosquito-borne disease. The MOHLTC is continuing to monitor for the presence of these mosquito vectors to determine the potential for human infection in Ontario.

[†] Pools contain up to 50 female mosquitoes from a single species (or combined species such as *Cx. pipiens* and *Cx. restuans*) collected from the same trap at a single site on a particular date.

This program will help provide a historical entomological data base around EEE which will be of importance should it become necessary in the future for Medical Officers of Health to make decisions on EEE surveillance and control strategies.

Selection of Mosquito Testing Service Providers

For 2007, WNV mosquito species identification and enumeration together with viral testing will be provided by various appropriately qualified service providers as selected individually by the 36 Health Units. The mosquito service providers have been required to pass a 'proficiency panel' screening by PHAC'S NML in Winnipeg, and to report their findings in standard reporting formats created by the MOHLTC for 2007. All Health Units will receive support as per cost shared formula for their mosquito trap submission costs. See attached listing of the mosquito species suggested for testing [Appendix II (b) and (c)].

Under Section 271 (1) of the Municipal Act, 2001, S.O. 2001, Chapter 25, Health Units have been required to adopt certain policies with respect to the provision of goods and services. Such policies were required to be in place by January 1, 2005. As such, Health Units will be requested to affirm that they undertook an open and competitive process to select their mosquito service contractor.

Vector (Mosquito) Consultancy for the Health Units

The MOHLTC provides entomological expertise through MOHLTC staff resources directly to the Health Units as requested by the local Medical Officers of Health.

Ministry – WNV Vector Database

In 2006, the Ministry established the first provincial vector surveillance database which contains mosquito surveillance data. This data is uploaded to the Ministry on a weekly basis from each of the mosquito testing service providers. The data includes trap locations, mosquito species abundance and distribution, as well as WNV-positive mosquito pools. The data is analyzed by Ministry staff to produce weekly provincial WNV vector surveillance reports. This provides a comprehensive provincial picture of the WNV vectors. The weekly reports are issued by the Ministry in confidence to the HUs and the Partners to assist in assessing the WNV human risk in Ontario. In 2007 the Ministry will continue to provide weekly WNV vector surveillance reports.

Field Consultation and Training

The MOHLTC will be available to provide field consultation to all Health Units to review local mosquito surveillance programs as well as providing 'hands-on' training for Health

Unit staff through regional practical seminars held in early May across Ontario. The MOHLTC will again provide the mosquito traps to the Health Units as required.

Geographic Information System – Program Component Development

In 2005, the Infectious Diseases Branch commenced the use of Global Information System (GIS) to record and manage disease surveillance information. This work continues through 2007.

Equine (Horse) Surveillance

Equine WNV cases will be reported to the MOHLTC by the Ministry of Agriculture, Food and Rural Affairs (OMAFRA). The Canadian Food Inspection Agency (CFIA) has made WNV in horses an immediately notifiable disease under its legislation, which requires diagnostic laboratories to report positive test results on a weekly basis. This information is forwarded to OMAFRA and placed on their website for public reference. OMAFRA will also notify Public Health Units of positive cases in their respective jurisdictions.

The MOHLTC website will be linked to the OMAFRA website for easy, accurate and timely equine WNV surveillance information at www.gov.on.ca/OMAFRA/english/livestock/horses/westnile.htm

With the widespread success of equine WNV vaccine, this information is becoming less useful as a surveillance tool.

Vector (Mosquito) Control

The Ministry of the Environment (MOE) is the regulatory provincial agency for all pesticide applications, including larviciding and adulticiding.

For West Nile Virus control, the Control of West Nile Virus Regulation provides the local Medical Officers of Health with a table outlining the action response levels where source reduction, larviciding or adulticiding may be an appropriate intervention following a comprehensive risk assessment.

A local risk assessment is an essential prerequisite to a decision to implement vector control measures. Control measures (larviciding or adulticiding) for WNV reduction must take into consideration all the available data. This would include identifying human populations at risk, any burden or impact of WNV mortality and morbidity in the human population, non-human surveillance findings, vector density, distribution and IRs (if available), seasonal dynamics, and the local weather, demographic and geographic factors. The Infectious Diseases Branch staff now has five years of processed historical entomological data available for review with Medical Officers of Health toward decision-making on mosquito control measures.

As indicated above, routine as well as ‘emergency’ adult vector control, “adulticiding” is often referred to as “spraying” or “fogging”. It is focused on specific geographic areas identified through a risk assessment where the human population is considered most at risk from WNV. Adulticiding represents a component in the full spectrum of control measures. It is a necessary inclusion in order to ensure a risk assessment grid is complete. In recognition of the obvious and ongoing public concern over pesticide use, the emphasis in the Plan and the Control of West Nile Virus Regulation is placed on personal protection and source reduction, followed by direct control activities (both larval and adult control). Source reduction must be seen as having two responsibility facets, one belonging to the community residents and the other to the municipality. Communication efforts are instrumental in educating the community on the various methods of vector reduction.

If the Medical Officer of Health determines that direct intervention is necessary, larviciding programs, especially early in the mosquito season, may be carried out with the expectation that the early reduction of mosquito species populations of concern at the immature stage will reduce the need for adulticiding programs later in the year.

Contingency Adulticiding

The MOHLTC has again made available to all Medical Officers of Health a contracted mosquito control service to adulticide with malathion within 48 hours notice in any Health Unit in Ontario. Prior to Ultra-Low Volume (ULV) treatment commencing, it is essential that the service provider (or the requesting MOH) has served the appropriate community notice of the treatment no sooner than 48 hours in advance or no more than seven days before.

This service is initiated at a request from the local Medical Officer of Health, and is cost-shared when called upon. Both truck-mounted and backpack ULV modes of malathion delivery are available to the local Medical Officer of Health.

Backpack ULV capacity will be available to service those situations where an MOH wishes to focus direct adult mosquito control in a very tightly defined area as identified to be an imminent WNV threat through the risk assessment process.

Surveillance of Potential Adverse Health Effects from Pesticide Exposure

Under the Control of West Nile Virus Regulation, the Health Units are required to maintain a means to record, investigate, and report any confirmed or likely adverse or unintended human health effects attributed to mosquito control actions. The Health Units are also required to report any non-human environmental adverse effects to the Ministry of the Environment and/or other relevant local or provincial authorities.

Research Cooperation with Public Health Agency of Canada

There are several studies under present discussion and will be reported upon when they are developed to the stage that appropriate information can be shared.

Among supported work are several epidemiological analyses being undertaken in partnership with PHAC and affiliated agencies.

I. Introduction

Continuing the Work

At the February 2006 *National meeting on West Nile virus and Other Non-Enteric Zoonotic Diseases* held in Montréal, Dr. Robbin Lindsay, Chief, Field Studies, Public Health Agency of Canada, speaking to Long-Term Strategies for Mosquito-Borne Disease Prevention, noted in part:

“Localized “hotspots” for virus amplification and risk of human disease will likely be maintained within some/many jurisdictions. The disease burden will vary within jurisdictions from year to year, driven by abiotic and biotic factors, and will continue to be weighed against the costs of prevention strategies relative to competing public health priorities. Mosquito control is the most expensive component of the WNV program. Resources to support surveillance and to control activities is likely to diminish in the foreseeable future as disease incidence stabilizes and WNV becomes “normalized” in public and political arenas.

Managing WNV means to maintain regional appropriate surveillance and capacity to intervene—at least in areas of greatest risk—and to continue the analysis of regional data that look for correlates of predictors of human epidemics, and to commit to two planks of WNV prevention (personal protective measures [PPM] and Integrated Mosquito Management IMM).

Vital to all this is the sustainability of programs. Specifically, history has shown that support for mosquito management ebbs and flows, but the programs based on nuisance control seem to stand. To evaluate efficacy, cost assessment of WNV programs should be measured against cost to public health systems.

Undoubtedly, in the future, our prevention strategy will be more focused, with perhaps less mosquito management. Moreover, it will be necessary to shift responsibility to the general public and promote behaviour change.

Accordingly, we need to:

- maintain capacity for surveillance and control*
- continue commitment to current prevention strategies*
- evaluate and refine all aspects of prevention strategy*
- expend more energy on personal protective products and methods of improving compliance to personal protective strategies.”*

Background for West Nile Virus Illness

West Nile Virus (WNV) can cause disease and mortality in many species of birds and mammals, including humans. Taxonomically, this arthropod-borne virus (arbovirus) belongs to a family of flaviviruses (Flaviviridae). More specifically WNV belongs to the Japanese encephalitis serocomplex of viruses, which includes the St. Louis encephalitis virus (which is closely related to WNV), Japanese encephalitis virus, the Kunjin and Murray Valley encephalitis viruses, and other flaviviruses.

The vectors which carry and transmit WNV are mosquitoes – *Culex*, together with other genera and species of mosquitoes and ticks: “soft ticks” (argasids) and “hard ticks” (ixodids). The WNV propagates in nature primarily through a “bird-mosquito-bird” cycle of transmission, as well as through a “bird-tick-bird” transmission cycle, in which the ticks feed on birds that provide a reservoir of the virus.

The urban cycle of the disease requires species of mosquitoes that feed on synanthropic or domestic birds and people. These are known as “bridge vectors” and evidence is suggesting that these are primarily *Culex pipiens* and *Culex restuans* in north-eastern North America including much of Ontario. While birds comprise the primary or reservoir hosts for the virus, mammals (including humans) function as incidental or dead-end hosts. In areas where the disease is endemic, the WNV has been found in mammals such as horses, camels, cattle, mice, hamsters, dogs, bats, lemurs, rabbits, squirrels and chipmunks.

WNV was named after West Nile province of Uganda in which it was first isolated in 1936. Since then, it has been a well-documented cause of human disease in Africa, West Asia, and Eastern Europe. The first reported epidemics occurred in Israel during 1951-1954 and in 1957. European epidemics of WNV encephalitis have occurred in southern France in 1962, in south-eastern Romania in 1996, and in south-central Russia in 1999. The largest recorded WNV epidemic occurred in South Africa in 1974. A major epidemic, with considerable mortality, began in Israel in the latter part of 2000.

Prior to the summer of 1999, occurrences of the West Nile virus had never been identified in the Western Hemisphere. The first known emergence of WNV in the Americas occurred in New York City in the late summer and fall of 1999, causing 61 confirmed human cases of encephalitis, seven (7) of which were fatal. The method of importation of WNV is unknown, but it may have arrived in an infected bird (including a migratory bird) or in mosquitoes. Genetically, the 1999 New York City strain of the virus most closely resembled a strain that was identified in Israel in 1998. By 2002, the virus had spread to many U.S. states, and to all but two states by 2005.

According to the latest CCWHC publication, the virus is now known to affect over 250 species of birds, 35 species of mammals and two species of reptiles over a large geographic area that, in Canada, spans from Nova Scotia to Alberta. Eagle, hawk, owl, robin, Eastern Bluebird, Cedar Waxwing, merlin, American kestrel, the endangered

sage grouse, Eastern gray squirrel and red squirrel are included in wildlife found positive for WNV.

In 2001, WNV was confirmed for the first time in Ontario in birds. Since then, the virus has spread to other provinces across Canada. Ontario recorded no human cases prior to 2002. In 2002, the Health Units initially reported 405 human WNV cases, a figure which has now been revised downwards as a result of careful ongoing case review with the Health Units. Following this re-examination, the total number of 2002 cases, probable and confirmed, has been reduced to 394.

Human Cases – WNV illness in Ontario

2001	nil
2002	394
2003	89
2004	14 (one travel related)
2005	101
2006	42

Public Health Roles in Ontario

Health Units

Health Unit responsibilities with regard to infectious diseases are set out in the Mandatory Health Programs and Services Guidelines (MHPSG) (see excerpt in Appendix IV) and the *Health Protection and Promotion Act* (HPPA) and its Regulations.

For WNV control, Health Units are to carry out appropriate surveillance activities to permit risk assessments for WNV to be performed within their respective jurisdictions. Under the Control of West Nile Virus Regulation Health Units are required to take measures deemed necessary to prepare for and prevent, if possible, the contracting of WNV illness within their communities. Each Health Unit is to maintain a regular communication link with their public to ensure that current information on WNV within the Health Unit is widely shared.

As part of their surveillance work, Health Units are responsible for the collection and submission to the CCWHC and their mosquito service provider of avian and mosquito specimens for laboratory analysis, and to establish and maintain sample collection and disease investigation records. These results are required to be reported to the Ministry to permit recording of the disease incidence in Ontario into various surveillance reports and maps for public health response coordination.

As part of their disease surveillance, Health Units investigate reported WNV-positive human cases, record their respective locations and exposures for analysis, and communicate relevant blood-donor or organ-donor information to the Canadian Blood Services. Further, the Health Units enter the results of their investigations of WNV cases into the Integrated Public Health Information System (iPHIS) reporting tool.

For those WNV Illness cases which may be travel-related, Health Units also coordinate an exchange of information with those jurisdictions in which their patient may have traveled as part of the Health Unit examination of the most likely location of exposure to WNV for the individual involved.

Ministry of Health and Long-Term Care

The MOHLTC is a continuing consultant to the Health Units for all matters related to WNV preparedness, prevention and control. The MOHLTC also supports the HUs in their work through cost-sharing of all WNV-related work through an up-loading formula established by the Minister annually.

The MOHLTC also provides logistical support through the direct funding of bird surveillance shipping costs to the Canadian Cooperative Wildlife Health Centre (CCWHC) in Guelph, Ontario, as well as cost sharing the mosquito testing services undertaken by the local Medical Officer of Health (MOH) along with the provision of all mosquito traps.

Further, the MOHLTC will continue an ongoing provincial public communication and information program to maximize public knowledge of WNV Illness and its prevention, and will also support local communication work carried out by the Health Units. The MOHLTC will also make the latest appropriate provincial data on WNV available on its public website.

In addition, the MOHLTC will provide provincial data analysis based upon the information provided by the Health Units following their investigation of WNV case reports together with the results of Ontario bird and mosquito surveillance. The MOHLTC maintains regular communication links with the Public Health Agency of Canada (PHAC) and with international contacts respecting WNV matters. The Ministry also supports selected WNV prevention or control initiatives which may be proposed from time to time, and will share the information learned with the Health Units and PHAC if applicable.

Public Education, Risk Communication and Community Outreach

Communications Objectives

- Maintain high level of awareness of the threat of WNV and combat complacency in the face of perceived declining personal risk.
- Continue to build on social and behaviour change levels achieved in previous campaigns.
- Increase the number of people taking personal precautions on a regular basis to prevent mosquito bites and to eliminate mosquito breeding sites around the house.
- Increase awareness that WNV is also an urban threat.

Communications Strategy

This year's communications strategy is to continue to provide Ontarians with the information they need about the precautions they can take to protect themselves and their families against contracting West Nile virus. The June to September campaign continues a social marketing approach to communications in order to make personal protection and eliminating mosquito breeding around the home second nature over the long term.

Tactics will include television advertising supported by print advertising in consumer magazines and newspapers; earned media; and collateral materials distributed through public health units and pharmacies across the province. New communication materials for 2007 will include transit shelter posters, radio advertisements and billboards. Ethnic communities will also be targeted through advertising and a fact sheet in 21 languages available on the website. Advertising and collateral materials will drive the public to the Ministry's INFOLine (1-877-234-4343) and website for more information.

Health Care Provider Outreach

Health care providers, especially those in acute care hospitals, must be informed about the human case definition for WNV illness which is a reportable disease in Ontario by Regulation. As in past years, the MOHLTC will provide physicians, other health care workers and the public access to the latest information on the Ministry website on human surveillance, clinical information and diagnostic testing. The Ministry maintains liaison with the Ontario Medical Association in this outreach.

Many HUs maintain a very close association with local hospitals as a routine component of their community disease surveillance.

Public Education Activities within Local Health Unit Areas

Public

The public and other local community stakeholders will require information and updates about the surveillance activities and the risk assessment outcomes determined by the local Medical Officer of Health regarding vector control activities.

In terms of prevention measures, the general public education campaign message must be re-emphasized around personal protection against mosquito bites, including the application of approved insect repellent. Outdoor recreational, tourism groups and senior citizens' residences may be targeted for presentations and advice on personal protective measures. Parents, schools and day care centers need information on the use of DEET-containing or other registered repellents on children.

Public and stakeholder education is also needed at the local level to encourage "source reduction" to include eliminating major sites of standing water on private properties (residential or commercial) and on public properties (e.g., ditches, ponds, reservoirs, street catch basins, sewage treatment facilities, etc.). The importance of source reduction increases when vector larval development sites have been identified close to residential areas. Source reduction at the local and regional level may involve the municipal departments of Public Works or of Parks and Recreation as well as local conservation authorities, and, of course, private property owners themselves.

Furthering the public education message can also be accomplished with school children (both elementary level and high schools), adolescents and senior citizens' groups as well as other community-based organizations. All of these groups are beneficial resources that should be encouraged to undertake standing water surveillance/source reduction in local neighbourhoods. Increased awareness among the members of this group will result in enhanced personal awareness. This will also result in local media coverage of activities which will further support Health Unit education or promotion activities.

Health Units are encouraged to continue their active community development role in such WNV Illness education work.

Planned Activities

- General public education messages reinforce protective clothing: wear shoes, socks, long pants, and a long-sleeved shirt when outdoors for long periods of time, or when mosquitoes are most active. Clothing should be light-colored and made of tightly woven materials that keep mosquitoes away from the skin. The use of mesh "bug jackets" or "bug hats" is recommended.

- If West Nile virus is found in a community, advisories will be issued to remind residents to:
 - Minimize unprotected time spent outdoors at all times, and particularly between dusk and dawn when mosquitoes are most active.
 - Use mosquito netting when sleeping outdoors or in an unscreened structure and to protect small babies when outdoors.
 - Consider the use of mosquito repellents and use according to directions when it is necessary to be outdoors.

- With respect to personal property, general public education messaging should be reinforced to encourage the public to remove any type of standing or stagnant water. Emphasis will be to:
 - Clean up and empty containers of stagnant water such as old tires, flower pots, wheelbarrows, barrels or tin cans that are outdoors
 - Change water in bird baths at least once per week.
 - Check swimming pools - remove water that collects on pool covers. Make sure the pools pump is circulating
 - Turn over wading pools when not in use
 - Check and clear eaves troughs and drains: - Clear obstructions from eaves troughs and roof gutters throughout the summer
 - Make sure drainage ditches are not clogged
 - Check flat roofs frequently for standing water
 - Carry out regular yard and lawn maintenance: lawn cuttings, raked leaves or other decaying debris such as apples or berries that fall from trees should be collected and recycled or mulched so that organic matter does not end up in storm sewers as a food source for mosquito larvae
 - Turn over compost frequently. The compost pile is not off limits to mosquitoes.
 - Fill in low depression areas in lawns
 - Trim dense shrubbery where mosquitoes like to rest

Local Source Reduction

Mosquito populations can be suppressed significantly by reducing or eliminating their typical aquatic larval development habitats, a preventive strategy known as "source reduction". The major vectors of WNV in Ontario are the *Culex* species which tend to develop in natural or artificial "containers" of standing water, usually of relatively small size. Other vectors of WNV, such as certain species of *Aedes* and *Ochlerotatus*, prefer to develop in temporary floodwaters or semi-permanent pools of water, respectively.

Municipal, local or regional authorities can engage in the following examples of source reduction activities:

- Conduct mapping of known or possible vector (mosquito) habitats. In addition to existing paper maps, mapping tools such as a geographic information system (GIS) with global positioning system (GPS) units are helpful. Should a municipal

department (e.g. Public Works, Parks and Recreation, Roads or Transit) not have GIS or GPS units, this service may be available through local conservation authorities, or the district offices of the Ministry of Natural Resources (MNR) or from the regional offices of the Ministry of Municipal Affairs and Housing (MMAH).

- Monitoring mosquito larval populations ("larval dipping") in bodies of stagnant water or in ditches/depressions 24 to 36 hours after major rainfalls. Storm water management ponds located in urban settings must be maintained with grass cut low on the edges of ponds. Urban drainage ditches and ground depressions may be drained, filled in, or re-graded in order to prevent the accumulation of long-standing stagnant water or of periodic "rain pools".
- Wetlands must not be drained or altered in any way, unless there is an exceptional circumstance of significant human health risk from disease-vector mosquitoes. Consultation with, and permission from, the MNR and the appropriate conservation authority will be required.
- Store tires inside a garage or shed or other water-protected situation. Discarded tires left outside collect water after each rainfall and create perfect aquatic sites for female mosquitoes to lay their eggs. Tires that have a field function, such as being anchors for tarpaulins, should have several holes drilled in them to allow drainage.
- "Tire Drives" can be sponsored at the local level (i.e. encourage citizens to bring in discarded tires for recycling).
- Flush or vacuum storm drains and catch basins frequently and ensure that ditches drain properly to remove stagnant water. This should be coordinated with larval control programs.
- Monitor sewage treatment plants, sewage lagoons and retention ponds to ensure they are not developing vectors. Cut grass and remove vegetation around the banks of sewage lagoons.
- Every effort and initiative must be considered to eliminate vector (mosquito) development sites on public and private property. Initiate closer "personal service" contacts with community institutions (places of worship, homeowner associations, business groups, and community service clubs) or initiate door-to-door promotion of mosquito larval development source reduction to industrial, commercial, recreational and residential property owners.
- Adopt municipal "show-by-example" activities to encourage source reduction and promote these activities at shopping malls, schools, community centers, etc.
- Promote mosquito development source site reduction campaigns by inserting fact sheets in taxation or local flyers.
- Offer presentations or displays at retail garden outlets, seniors' centers, and gardening clubs in order to increase awareness among persons more susceptible to WNV disease (e.g. older adults).
- Consider enacting by-laws to require mosquito development site (source) elimination or reduction, particularly in urban areas.

II. Surveillance Indicators

Major Host (Bird) Surveillance

Objective

To utilize bird mortality as a means of early detection of West Nile virus activity in order to inform public health measures taken to reduce the potential risk of human WNV illness.

Background

In Ontario, birds which have been identified with WNV by the Canadian Cooperative Wildlife Health Centre include the red-tailed hawk, Coopers hawk, sharp-shinned hawk, northern goshawk, American kestrel, osprey, great horned owl, ring-billed gull, great black-backed gull, American robin, blue jay, American crow, raven, and the Canada goose.

Selection of Surveillance Species

In Ontario however, for WNV-avian surveillance purposes, corvids (i.e., crows, blue jays and ravens) are particularly useful. These particular birds have a high mortality rate if infected with WNV, are conspicuous, easily recognized by the public and are relatively common where they are endemic. This makes their carcasses available to be tested in the locations where they died. The timing of submission of birds to the CCWHC by public health units is based on knowledge of the life-history and period of activity of *Culex* species of mosquito vectors of WNV. Each Health Unit is allotted a fixed number of submissions per week for WNV testing to optimize the distribution of dead bird surveillance, in relation to the resources available.

Not a Survey of Bird Illness

The WNV bird surveillance is not intended as an ongoing monitoring of the status of bird health with respect to WNV.

Purpose of WNV-Avian Surveillance

The purpose of bird surveillance is to establish that WNV is present in the Health Unit, and to a limited extent, its distribution. This is key information that assists the medical officer of health for each local Health Unit in decision-making. This permits some indication of when and where the potential for mosquito contact with WNV-infected birds might be, particularly if there are a number of such infected corvids in a given locale.

Once it is established that WNV exists in the bird population within a local health unit, it is appropriate to assume that WNV infection is endemic in wild birds in that jurisdiction for the duration of the WNV transmission season. Absence of positive findings should not be construed as meaning that WNV is not active. It may be the product of inadequate intensity or distribution of sampling effort, which is characteristic of passive surveillance systems.

With WNV conclusively determined to be in a Health Unit, further bird testing is no longer deemed necessary, and the CCWHC may re-allot surveillance to other areas within the Province where WNV activity has yet to be demonstrated.

Planned Activities

The surveillance of selected dead birds for WNV remains a public health activity for 2007. Dead blue jays, crows and ravens will continue to be submitted, wherever they occur.

Commencing in May 2007, dead bird submission activities will be phased in based on the schedule distributed to the Health Units by the Canadian Cooperative Wildlife Health Centre. The continuing goal is to test in those Health Unit areas most affected from 2002 - 2006 in order to identify the presence of WNV-infected birds as early in the season as possible.

Health Units will collect and submit appropriate dead crows and blue jays (and those Health Units in the north may include ravens) to the CCWHC in Guelph. The birds will be VecTested™ (see page 19) and the first birds found positive in a health unit or major municipality will be confirmed to be positive for WNV by polymerase chain reaction (PCR) testing to eliminate the risk of a false positive test influencing the initial public health response to WNV infection.

Positive WNV results will be reported to the submitting Health Unit and to the Infectious Diseases Branch simultaneously with the results posted to the Public Health Agency of Canada website after a 2-day embargo period.

The MOHLTC website will provide a direct link to the Public Health Agency of Canada website for easy, accurate and timely reference for bird results at www.phac-aspc.gc.ca/wnv-vwn/mon_e.html

"Sightings" Reports

Unlike the birds picked up and submitted for WNV determination by the Health Unit, "sighting" reports are anecdotal communications received by the Health Unit from the public telling of a dead bird somewhere in the community, but usually without the bird having been seen by Health Unit staff. These birds may be from any species.

The practical use of this unconfirmed information since 2002, while somewhat inconsistent in determining risk, remains data utilized by many of the Health Units in their risk assessment considerations. Some of the reporting inconsistency may be because these citizens' reports are frequently of questionable accuracy respecting the species of the bird(s) reported, its location, and the number birds seen or even whether it is a bird. In addition, the same bird may be reported multiple times.

Undetermined Causes of Bird Death

One obvious difficulty with the use of the sightings data is that the dead birds reported may have died of causes other than WNV.

Nevertheless, major increases in dead bird sightings have been reported in association with the onset of intensive WNV activity in mosquitoes. Hence, dead bird 'sightings' may be a useful auxiliary piece of information for risk assessment purposes. It is suggested that Health Units maintain a file of 'sighting' reports for their own information, and advise their community regarding the Health Unit's program for collection of bird samples and particularly which type of bird (i. e. crows, blue jays and ravens) the public should call in.

Situations where a large number of birds appear to have died without obvious explanation should be reviewed by telephone with the CCWHC. This is important in 2007 in light of current concerns about highly pathogenic avian influenza. Submissions of such cases may be encouraged for full diagnostic work-up by the CCWHC.

For further information see Appendix III under 'Other Species of Birds and Mammals'.

Experience in the United States over the past few years has demonstrated some correlation between bird deaths and human cases shortly thereafter, and all Health Units are encouraged to consider this surveillance tool.

The "VecTest™"

In 2003, a new WNV screening tool, known as the VecTest™, was utilized by CCWHC and has proven effective through 2004-2006. This test involves taking a swab of the oro-pharyngeal area (the back part of the mouth and throat area). The tests results are usually available on the same day. All VecTest™ positive results will be reported directly by CCWHC to the Health Unit involved, to the Infectious Diseases Branch, and to the Public Health Agency of Canada.

The VecTest™ is 85% sensitive and 95% specific in crows. Sensitivity is the ability of the test to detect the infection when it is present (a lack of sensitivity increases the rate of false negatives). Specificity is the ability of a test to determine the absence of infection (a lack of specificity increases the rate of false positives). While the number of false positive VecTest™s is very low, the first VecTest™ positive birds in a health unit or major municipality will be confirmed by PCR, since this is a 'high stakes' result that

may up-regulate public health activity, and stimulate public interest. Once WNV activity has been established in a jurisdiction by PCR confirmation, VecTest™ results will be accepted at face value.

Scheduling for Dead Bird Surveillance

Scheduling and management of dead bird surveillance is the responsibility of the Canadian Cooperative Wildlife Health Centre. The timing and distribution of surveillance effort will be modulated in consultation with the health units involved, as the temporal and geographic pattern of WNV activity evolves in Ontario through summer 2007. Health Units are encouraged to submit suspect birds as early in the schedule as their local service permits for early detection of WNV-positive birds.

Should suspicious bird mortality occur prior to these dates, Health Units are asked to contact CCWHC about whether to submit such samples. The CCWHC are interested in diseases other than WNV, even though they would likely determine the sample's WNV status as part of the case work-up regardless of their other disease interests.

Dead Bird Submission Schedule for 2007	
Commencing May 14	Health units in Ontario south of North Bay & Sudbury Health Units
Commencing May 28	Health Units in northern Ontario

Shipping Protocol

Shipments will be made "PUROLATOR COLLECT", using pre-printed courier waybills and submission forms, which will be sent to each Health Unit by CCWHC before their respective start date.

For further details concerning the protocol for reporting and submission of dead bird specimens in Ontario, please refer to the protocol in Appendix V, "The Handling and Submission of Specimens - Ontario West Nile Response", by Dr. Ian Barker of the Canadian Cooperative Wildlife Health Centre in Guelph.

The Public Health Agency of Canada (PHAC) supports the WNV-avian testing at the CCWHC and the MOHLTC supports the shipping costs involved from the Health Unit to the CCWHC in Guelph, Ontario.

Human Surveillance

Objective

To detect and describe WNV illness in humans to help identify risk factors including areas of risk.

Background

Human Clinical Manifestations

The clinical manifestations of WNV illness and associated long term conditions continue to be identified as scientific literature becomes available. The most recent symptoms and complications can be found in the WNV human case definition [Appendix I (a)].

Planned Activities

The activities for human surveillance will be implemented throughout the healthcare system and involve practicing physicians, hospitals, public health laboratories, local Medical Officers of Health and the Public Health Division of the Ministry of Health and Long-Term Care. In addition, surveillance information is shared with Canadian Blood Services to ensure the safety of Canada's blood supply.

Human surveillance is activated by the Central Public Health Laboratory (CPHL) reporting a positive WNV test result to the respective physician who then reports it to the local MOH. The Health Units then interviews the individual testing positive for WNV or their physician. The results of the case investigation are reported using the Integrated Public Health Information System (iPHIS) system and are then available to the Ministry.

Human surveillance is based on the use of the following information:

WNV Illness is based on the national case definition provided by the Public Health Agency of Canada (PHAC) for reporting the disease, "WNV Illness" can be considered to consist of two clinical pictures, "WNV Non-Neurological Syndrome" and "WNV Neurological Syndrome". There is also a case definition for "WNV Asymptomatic Infection" [Appendix I (a)]. Data from the U.S.A. indicate that most WNV infections do not cause any disease. Approximately 20% of people infected develop a relatively mild illness (WNV Non-Neurological Syndrome), or as cited in public education literature, 4 out of 5 people who become infected with WNV do not show any symptoms. Approximately 1 in 150 (0.7 %) of infections will result in severe neurological disease.

WNV Non-Neurological Syndrome (formerly known as "West Nile Fever") is the milder form of WNV Illness. Clinical symptoms include a sudden onset of one or

more of the following: fever, malaise, anorexia, nausea, vomiting, headache, eye pain, photophobia, arthralgia, myalgia, and maculopapular rash. The complete clinical spectrum may not yet be fully identified.

WNV Neurological Syndrome may include the symptoms of WNV Non-Neurological Syndrome. In addition to these symptoms, manifestations may include change in mental state, severe muscle weakness, acute flaccid paralysis, myelitis, seizures, polyradiculitis, cranial nerve abnormalities including optic neuritis, ataxia and extrapyramidal signs.

Surveillance for West Nile Virus Illness (Case Definition)

Ontario's WNV case definition [Appendix I (a)] is based on the Public Health Agency of Canada's case definition, and is updated as needed from time to time to be consistent with the national case definition. Similarly, diagnostic test criteria are subject to change as new information becomes available.

For surveillance purposes, WNV Illness will consist of WNV Neurological Syndrome (WNNS), WNV Non-Neurological Syndrome (WN Non-NS), and WNV Asymptomatic Infection (WNAI). WNNS and WN Non-NS will consist of the categories "Suspect", "Probable" and "Confirmed", and WNAI will consist of the categories of "Suspect", "Probable" and "Confirmed", respectively, depending on laboratory diagnostic test results.

The case definitions have two criteria for each of WNNS, WN Non-NS, and WNAI. One criterion is based on clinical features of the illness and the other criterion is based on laboratory test results.

WNV Case Categories

Table 1 provides a summary of the various categories of WNV cases identified by the interpretation of the primary laboratory test data. For additional information on other laboratory tests and specific clinical criteria, please refer to the Case Definition[‡] document (see Appendix I).

[‡] The human case definition may be updated from time to time in accordance with the human case definition adopted at the time of reference by the *National Steering Committee on West Nile Virus*, a committee of the Public Health Agency of Canada.

WNV Case Recording on MOHLTC Website

For the purposes of recording human WNV Illness cases on the public website, “probable” or “confirmed” human cases will be reported as the total number of human cases.

Table 1: Categories of Human WNV Cases

Illness Type	Category	Clinical Criteria	Laboratory Criteria
West Nile virus Neurological Syndrome	Suspect	Yes	Pending or Serum IgM ELISA Indeterminate
	Probable	Yes	Serum IgM ELISA Positive
	Confirmed	Yes	Serum IgM ELISA Positive plus Confirmation by PRNT*
West Nile virus Non-Neurological Syndrome	Suspect	Yes	Pending or Serum IgM ELISA Indeterminate
	Probable	Yes	Serum IgM ELISA Positive
	Confirmed	Yes	Serum IgM ELISA Positive plus Confirmation by PRNT*
West Nile virus Asymptomatic Infection	Probable	No	Serum IgM ELISA Positive, or NAT** by CBS***
	Confirmed	No	Serum IgM ELISA Positive or positive Nucleic Acid Test (NAT) by CBS*** plus Confirmation by PRNT * or <u>second</u> positive NAT**

* Plaque Reduction Neutralisation Test

** Nucleic Acid Test

*** Canadian Blood Services

Note:

For the purpose of surveillance in the 2007 season the first three IgM positive cases per health region (i. e. Northwest, Northeast, Southwest, Central West, Central East and Eastern.) will be confirmed by the Plaque Reduction Neutralisation Test (PRNT). However, the Central Public Health Laboratory will maintain an ongoing and random regimen of periodic confirmation of IgM positive results by PRNT in a health region as

quality control and to identify any other viral presence which may produce a positive IgM result (i. e. other flavivirus). Further, Health Units may request PRNT confirmation.

Reportable Disease Requirements in Ontario

WNV Illness is both a *Reportable Disease* and a *Communicable Disease* under the *Health Protection and Promotion Act, Regulation 558/91 and 559/91*, respectively as of May 1, 2003.

Reporting responsibilities include:

Physician

Reports human WNV Suspect, Probable, and Confirmed cases, as per any reportable disease, to the local Medical Officer of Health

Local Medical Officer of Health

Reports information on human WNV Probable and Confirmed cases to the Infectious Diseases Branch (IDB) through iPHIS using the guidelines in the *Human Case Investigation Report for West Nile Virus* [Appendix I (e)].

Note:

Health Unit staff are asked to remind acute care hospitals in the Health Unit area on a regular basis, at their discretion, from the beginning of July through the end of November to ensure ongoing reporting for WNV cases.

Modes of Transmission

The mode of transmission that accounts for the majority of human infections is mosquito transmission. Since 2002, several new modes of transmission were identified. These modes included human blood borne transmission, vertical transmission via mother's milk and intra-uterine transmission, and transmission via occupational hazards in the case of laboratory employees and turkey ranch workers. Risk of transmission to hunters is also noted as a result of potential transmission from infected animal tissues. Most recently, the CDC reported three transmissions of WNV to organ recipients from an infected donor in August and September of 2005.

Blood borne Transmission

Transmission of WNV via human blood and organs has been documented in several cases in the U.S.A. Initial and current reports are available in *Morbidity and Mortality Weekly Report (MMWR)* October 4, 2002/51(39): 879; February 7, 2007/56(4): 76.

Organ Transplant Transmission

In September 2005, West Nile virus (WNV) infection was confirmed in three of four New York State and Pennsylvania recipients of organs transplanted from a common donor. Two recipients subsequently had neuroinvasive disease, one recipient had asymptomatic WNV infection, and a fourth recipient apparently was not infected. This report summarizes the ongoing investigation. As a result, CDC advises that clinicians should be aware of the potential for transplant-associated transmission of infectious disease. (Morbidity and Mortality Weekly Report (MMWR) October 5, 2005//54(Dispatch); (1- 3).

Vertical Transmission

Maternal Milk Transmission

Transmission of WNV from mother to infant via the mother's milk was considered the most likely source of an infant's infection in one case-report. The report is available from *MMWR October 4, 2002/51(39); 877-878*.

Intrauterine Transmission

Intrauterine transmission of WNV is documented in *MMWR December 20, 2002/51(50); 1135-1136*.

Occupational Hazards

Laboratory, Field and Clinical Workers

Initial reports of WNV infection in laboratory workers acquired through percutaneous injection while handling infected birds are available in *MMWR December 20, 2002/51(50); 1133-1135*. It is recommended that laboratory workers handling fluids or tissues known to be, or suspected to be, infected with WNV should minimize their risk for exposure. Laboratory workers should follow standard universal precautions and use good laboratory practices and techniques as outlined in their facility's policy for managing exposure to blood-borne pathogens when handling tissues or fluids known or suspected to be infected with WNV.

The Centres for Disease Control, National Institute for Occupational Safety and Health, posts their latest recommendations for protecting laboratory, field and clinical workers from WNV on their website at www.cdc.gov/niosh/docs/2006-115

Turkey Ranch Workers

Given the report in respect of WNV infection being contracted through exposure to turkeys in the state of Wisconsin (MMWR October 24, 2003) it is prudent to ensure that such workers be given awareness training on modes of exposure to WNV. Included should be advice on the wearing of protective clothing and gloves, encouragement to frequently wash hands, and using DEET-containing or other registered repellents.

The training should also encourage them to report illness to their employer, particularly if it is compatible with the symptoms of WNV illness.

While the evidence to date is limited to turkeys, other poultry may present an occupational WNV risk to workers as well.

Hunters

As a result of the potential for transmission of WNV via infected animal tissues, the Centers for Disease Control and Prevention in Atlanta, Georgia, have issued warnings to wild game hunters to take personal protective measures against being bitten by vectors, and to use prophylactic measures when handling animal carcasses. For information, hunters are directed to the website at www.cdc.gov/ncidod/dvbid/westnile/q&a.htm

Special Protocols for Information Sharing between Health Units and Associated Agencies

Protocols have been developed and are available in Appendix I (b), (c) and (d). These include reporting forms to be used when providing information from:

1. Health Units to the Central Public Health Laboratory [Appendix I (b)]
2. Health Units to the Canadian Blood Services (CBS) [Appendix I (c)]
3. Health Units to Trillium Gift-of-Life for human organ donations [Appendix I (d)].

Vector (Mosquito) Surveillance

Objective

To identify the local areas where the presence of WNV poses the most direct threat to humans through risk assessment, using surveillance data (particularly vectors) toward decision-making.

Background

Vectors are those mosquitoes that can transmit WNV from one organism to another. In Ontario, mosquitoes have been categorized into two types, bridge vectors and enzootic vectors. Enzootic vectors primarily feed from birds, and thus maintain the zoonotic cycle of viral transmission. Bridge vectors consist of mosquito species that feed on birds and humans, and thus pose greater risk to humans. There is evidence that some species once believed to be enzootic vectors may also be bridge vectors, one such example is *Culex pipiens*. Although this species remains the primary enzootic vector, studies have shown that it will feed on mammals including humans. Within Ontario the majority of positive pools have been from *Cx. pipiens*, *Cx. restuans* and *Cx. pipiens/restuans*. Thus Ontario's main species of concern are *Cx. pipiens*, *Cx. restuans* and *Cx. pipiens/restuans*.

Extrinsic Incubation Period (EIP)

A WNV-infected mosquito does not indicate that the mosquito is necessarily a viable vector. If the virus is present in the mosquito's intestinal tract shortly after a blood meal, the mosquito may be infected but is unlikely to be able to transmit the virus. The virus must enter the mosquito's salivary glands through its system in order to transmit the virus. This *extrinsic incubation period* (EIP) is the time from ingestion of virus to the time it appears in the salivary glands. Therefore, if the mosquito's life span is less than the EIP, the infected mosquito cannot transmit the virus because it has not lived long enough to incubate the virus into its own system. For most mosquitoes which carry the WNV this extrinsic incubation period is estimated from 10 to 12 days in ideal conditions and longer when conditions are less than ideal.

Ontario's Program

Ontario's program for vector surveillance is focused toward the prevention and the control of WNV and vector surveillance remains the mainstay for the prevention and control of WNV.

Mosquito testing is supported by the MOHLTC from June 11 through to September 30, 2007 per the established cost shared formula extant of 75%.

The purpose of vector (mosquito) surveillance is to help determine the immediacy of the risk from contracting WNV in the Health Unit. This is the most important information piece required by the Medical Officer of Health for each local Health Unit for purposes of decision-making in the prevention and control of WNV illness.

Vector (mosquito) surveillance was identified as the most important data in the risk assessments undertaken by the Health Units in 2003, 2004, 2005 and 2006 under the Control of West Nile Virus Regulation. The MOHLTC cost-shares the contracts for mosquito sample submissions undertaken by the local Medical Officer of Health with private service providers.

The basic vector surveillance consists of adult mosquito trapping from spring to fall for:

1. the identification of trapped mosquitoes down to species level with suggested reference to the list of known WNV vectors in Appendix II (b)
2. establishing the numbers of mosquitoes by species, and if requested by the MOH,
3. carrying out a Real Time Reverse Transcriptase Polymerase Chain Reaction (RT-PCR) test to determine the WNV status of three of the mosquito pools in the submitted sample. See Appendix II (c and d)

Following active mosquito trapping data analysis from 2001 through 2006 across the Province, it has now been established that more than 20 species/groups of species have tested positive for WNV. These species are now the focus of Ontario's viral testing. Five years worth of surveillance data indicates that *Cx. pipiens*, *Cx. restuans*, *Cx. pipiens/restuans* are the main vector of concern in Ontario. These species are again recommended to get prime attention for WNV viral testing.

Trap locations

Since the mosquito traps are placed by the Health Unit personnel, WNV positive mosquito pools data are area-specific, and are, therefore, an excellent indicator of the relative threat from WNV in a particular locality where the traps were placed. This could include a village or other defined community, or specific intersections, back yards or municipal park areas.

Permanent and 'Flexible' Locations

Trap locations may be permanent or 'flexible'. Permanent trap locations may be set by the Health Unit in the same community location year after year. "Flexible" locations may be added to determine the mosquito species and the possible presence of WNV in new locations of interest. Having fixed and flexible trap locations gives the most useful

representative coverage of the jurisdiction in most cases in Ontario. It also permits response to local concerns.

Secondary Vector (Mosquito) Surveillance for the virus of Eastern Equine Encephalitis (EEE)

Ontario has also initiated a secondary adult vector surveillance program focused upon *Culiseta melanura* which is the main vector of EEE. The surveillance for these vectors will be incorporated into the WNV surveillance programming across Ontario.

While Ontario has never had a human case of EEE, equine EEE was found in one Health Unit in 2004 and in nine Health Units in 2003. Nevertheless, it is regarded as an important mosquito-borne human disease because it continues to appear immediately south of the Ontario border in the United States. The MOHLTC will continue monitoring for the presence of the EEE vectors to determine the potential for human infection in Ontario.

This EEE program component will help the Medical Officers of Health in decision-making on control strategies as well as building a historical entomological data base around EEE should the disease manifest itself in the province.

It is recommended that the Health Units ask their mosquito testing service provider to test all *Cs. melanura* for EEE.

Selection of Mosquito Testing Service Providers

For 2007, WNV mosquito species identification and enumeration, together with viral testing, will be provided by the several appropriately qualified service providers as selected individually by the 36 Health Units. The mosquito testing service providers will be required to undergo a 'proficiency panel' verification test provided by the National Microbiology Laboratory (Winnipeg). Service providers are required to simultaneously report the mosquito surveillance data with the Health Unit and the MOHLTC using the mosquito identification and viral testing templates that were created in 2006. As in 2006, this data will be provided to the MOHLTC via the MOHLTC FTP site. All Health Units will receive funding support at the standard up-loading formula for the year.

Under Section 271 (1) of the Municipal Act, 2001, Health Units are required to adopt certain business policies with respect to the provision of goods and services. Such policies are required since January 1, 2005. Consequently, Health Units will be requested to affirm that they undertook an open and competitive process to select their mosquito testing service provider.

Vector (Mosquito) Consultancy for the Health Units

The MOHLTC provides entomological expertise through MOHLTC staff resources directly to the Health Units as requested by the local Medical Officers of Health.

Ministry – WNV Vector Database

In 2006, the Ministry established the first provincial vector surveillance database which contains mosquito surveillance data. This data is uploaded to the Ministry on a weekly basis from each of the mosquito testing service providers. The data includes trap locations, mosquito species abundance and distribution, as well as WNV-positive mosquito pools. The data is analyzed by Ministry staff to produce weekly provincial WNV vector surveillance reports. This provides a comprehensive provincial picture of the WNV vectors. The weekly reports are issued by the Ministry in confidence to the HUs and the Partners to assist in assessing the WNV human risk in Ontario.

In 2007 the Ministry will continue to provide weekly WNV vector surveillance reports.

Field Consultation and Training

The MOHLTC will be available to provide field consultation to all Health Units to review local mosquito surveillance programs as well as providing ‘hands-on’ training for Health Unit staff through regional practical seminars held in early May across Ontario. The MOHLTC will again provide the mosquito traps to the Health Units as required.

Geographic Information System – Program Component Development

In 2005, the Infectious Diseases Branch commenced the use of Global Information System (GIS) to record and manage disease surveillance information. This work continues through 2007.

Mosquito Traps to include ‘Gravid’ Trap Option

As noted, the MOHLTC will provide the mosquito traps to the Health Units as appropriate.

The mosquito traps utilized in Ontario are mainly CDC ‘light’ traps which use both CO₂ and light to attract mosquitoes. In addition to the CDC traps, nine Health Units piloted the use of ‘Gravid’ traps in 2004. Gravid traps are designed to attract female mosquitoes that are looking for a site to lay their eggs. Gravid traps are frequently used to monitor for ovipositing *Culex pipiens*, *Culex restuans*, *Culex pipiens/restuans* and *Ochlerotatus japonicus* populations.

The pilot work confirmed the sensitivity of the Gravid traps in targeting these specific vectors in their correct physiological stage (gravid mosquitoes) with limited catches of

other non-involved species or earlier stages of targeted mosquitoes. With the increasing evidence that *Culex pipiens*, *Culex restuans*, *Culex pipiens/restuans* are the primary vectors of concern it is anticipated that a number of Health Units will continue to use Gravid traps in 2007 as part of their surveillance programming. However their set-up, transportation and operation are more resource demanding than the use of the simpler CDC light traps and therefore may not be used that extensively.

Planned Activities

Vector (mosquito) surveillance in Ontario in 2007 will enumerate and identify the presence of WNV-competent vector species of mosquitoes and determine the WNV viral status of the mosquito pools as deemed necessary by the MOH.

For 2007, however, because of the evidence that *Cx. pipiens*, *Cx. restuans*, *Cx. pipiens/restuans* are the main vectors in Ontario, the MOHLTC is recommending that, regardless of their numbers, HUs include any of these species identified in their traps be tested for WNV. This information to the Health Units will assist:

- Health Units with vector data for their risk assessment to support action decisions, including the decision to larvicide or adulticide or to withhold immediate action;
 - in providing information about the risk to the public of acquiring WNV illness based on the presence of WNV within specific local areas.
 - Health Units in the initiation of timely control operations/intensify ongoing vector control operations to break the transmission and mitigate the risk to humans and other affected species.
 - Health Units in evaluating their control operations
- In addition, the MOHLTC is working to determine the vector population densities from 2001 through 2006 for each Health Unit through 2007, and will be making the information available to the respective Medical Officers of Health when it is available and on request.
 - For 2007, WNV mosquito enumeration, species identification and viral testing will be provided by various appropriately qualified service providers as selected by each of the 36 Health Units. The mosquito testing service providers will be required to use the established WNV vector templates created by the MOHLTC. The mosquito testing service providers are requested to provide MOHLTC with weekly data during the WNV season. All Health Units will receive funding at the cost-shared formula extant for the present year for the allotted number of mosquito trap submissions approved by the MOHLTC. See attached listing of mosquito species to be reported upon if present in submitted samples [Appendix II (b)].
 - Health Units are requested have their mosquito testing service provider share the mosquito surveillance data concurrently with the MOHLTC for monitoring and for posting on the MOHLTC website.

- Both CO₂-baited CDC light traps and “Gravid” traps may be used in 2007. This is the recommendation of the mosquito sub-group of the National Steering Committee for West Nile Virus chaired by the Public Health Agency of Canada. Health Units will be provided with the appropriate number of CDC light traps and Gravid traps[§] prior to the start of the season.
- The MOHLTC will be providing training in the use and the placement of the various traps provided to the Health Units, including the use of gravid traps.
- The MOHLTC will calculate the mosquito infection rates (IR’s) and maintain a data sheet and records for Health Units’ reference upon request.
- The MOHLTC will provide a weekly provincial vector surveillance report to all of the Health Units.
- The MOHLTC website will record the WNV-positive mosquito pools as reported and confirmed by the mosquito testing service providers.

[§] On request

Equine (Horse) Surveillance

Objective

To monitor WNV in horses in Ontario to identify the geographic presence of WNV as an indicator of potential human exposure.

Background

Ontario equine cases were first recorded in 2002 with a total of 107 reported. In 2003 there were 11 horses reported positive for WNV, another nine (9) in 2004 and five (5) in 2005.

WNV in horses often occurs concurrently, or sometimes just prior, to confirmation of human infection. It is thought that the high intensity of mosquito exposure frequently experienced by horses makes them a useful sentinel species. The 1999 New York experience depicted equine cases in advance of human cases and in low populated areas where there was no other non-human evidence. Thus, equine surveillance may be important, particularly in rural settings, as an indicator of West Nile virus activity and of human risk. The usefulness of equine surveillance has become limited since the cost of testing for WNV is usually borne by the horse owner and horses are commonly vaccinated against WNV infection.

Equine Vaccine

An equine vaccination product is available from veterinary practitioners in North America. The Ontario Ministry of Agriculture, Food and Rural Affairs (OMAFRA) promotes the WNV vaccination of horses to veterinarians and the equine industry in Ontario. Equine practitioners can send serum or tissue samples to the Animal Health Laboratory in Guelph, or to other private veterinary diagnostic laboratories, for analysis. While there is no federal policy for action on equine WNV, laboratories must notify the Canadian Food Inspection Agency of any positive test result for equine WNV.

Planned Activities

Equine WNV cases will be reported to the MOHLTC by the Ministry of Agriculture, Food and Rural Affairs. The Canadian Food Inspection Agency (CFIA) has made WNV in horses an immediately notifiable disease under its legislation, which requires diagnostic laboratories to report positive test results. There is no requirement to report results to OMAFRA, but informal agreements have been made with diagnostic laboratories to share this information. OMAFRA will place case data on their website for public

reference and will also notify Public Health Units of positive cases in their respective jurisdictions.

For 2007, the Ministry of Agriculture, Food and Rural Affairs website will be linked from the MOHLTC website to permit easy, accurate and timely access to the data without duplication. The OMAFRA website linkage is www.gov.on.ca/OMAFRA/english/livestock/horses/westnile.htm

III. West Nile Virus Prevention and Control

Vector (Mosquito) Management (Immatures and Adults)

Objective

To control vector mosquito populations through the use of Integrated Pest Management techniques.

Background

Cx. pipiens, *Cx. restuans*, *Cx. pipiens/restuans* are the primary vectors of WNV and some of the most common mosquitoes found in urban areas. These mosquitoes breed quickly and use standing water containing decaying organic materials to lay their eggs. Common larval development sites include catch basins, discarded tires, poorly maintained bird baths, artificial containers, any refuse that allows standing water to puddle, clogged drain gutters, unused swimming and plastic wading pools, storm drains, pots and pans with standing water, standing pools of ground water and puddles that last for a week or more.

Planned Activities

Source Reduction Encouragement

- Targeting the elimination of larval development sites (referred to as Source Reduction) is the simplest and most effective larval control to reduce the number of vectors (mosquitoes). The MOHLTC public education campaign emphasizes personal protective measures and homeowner guidelines to reduce vector larval development sites on personal property. Local Health Units should emphasize elimination of larval development sites within their local communities at a resident level, including commercial sites, which are often significant sources of potential larval development.

- In addition, the Health Unit should lead local municipal attention to appropriate larval control measures in municipally controlled bodies of water catch basins; ponds; sewage treatment plants; drainage systems; storm water management ponds, etc.

Direct Vector (Mosquito) Control Measures

- Vector control to manage larval populations for WNV or other vector-borne diseases requires larviciding involving the use of approved pesticides. Larvicides are usually dispensed in the form of pellets, granules or briquettes (ingots) that are dropped into pools or containers of stagnant water where vectors (mosquitoes) are developing. Larvicides can be biological or chemical products. Three products are currently approved for larval vector control in Ontario: methoprene, *Bacillus thuringiensis israelensis* (Bti) and *Bacillus sphaericus* (*B. sphaericus*).
- Vector control to manage adult mosquito populations for WNV or other vector-borne diseases requires the use of an approved adulticide. Adulticides control the adult stage of mosquitoes or other flying insects. Adulticides are usually dispensed in the form of a liquid suspension in air using special equipment called ultra-low volume (ULV) application units. These units create a mist containing very small droplets of insecticide that are airborne for up to 30 minutes depending on weather conditions, killing any mosquitoes that are exposed to the droplets. Adulticides may be delivered by backpack sprayers, truck-mounted ULV equipment, or by aircraft. The adulticide product currently approved for use in Ontario is malathion.
- For additional information on larvicides and adulticides, license and permit requirements and public notification, refer to the fact sheets and permit applicant guides posted on the MOE website at <http://www.ene.gov.on.ca> and link to the West Nile Virus icon. The Pest Management Regulatory Agency (PMRA) also has several fact sheets posted on their website addressing larvicides and adulticides available at www.pmra-arla.gc.ca/english/aboutpmra/about-e.html

Decision-Making and Consultation

The decision to conduct larval vector (mosquito) control, including larviciding or adult vector (mosquito) control, including adulticiding in Ontario is established through the application of the provisions of *O. Reg. 199/03* (see Appendix V). While seniors and the immuno-compromised are at relatively greater risk of serious illness, once infected with the virus, consideration of this factor should be balanced against the knowledge that infection and serious illness have occurred in a wide range of ages in Canada and the U.S.A. In the current public education campaign, prevention messages note that “everyone is at risk”.

The determination of where to apply these control measures, particularly larvicide or adulticide, requires a local risk assessment. The assessment should weigh the level of risk to public health from the mosquito-borne virus based on the most current, available

evidence of local WNV activity in the human population and in non-human species (dead birds, positive birds, WNV-positive mosquito pools, mosquito infection rates and reported equine infections). All of these factors, plus taking into account all other control measures available (e.g. mosquito larval development site source reduction) are to be considered in weighing the expected benefits and risks of pesticide use.

The local Medical Officer of Health is the appropriate official to make a decision after receiving the aforementioned information from Health Unit staff and other municipal or regional agencies and, if necessary, from consultation with provincial, federal or private sector authorities and experts.

The MOHLTC's Vector-Borne Disease Unit of the Infectious Diseases Branch in the Public Health Division is available to the 36 Health Units to consult concerning any of these decisions.

General Decision-Making Factors: Larviciding and Adulticiding

A local risk assessment is the most critical prerequisite to decision-making regarding where and when to commence vector control. The assessment must be based on the most current and accurate data available. Consideration should include, but is not limited to the following:

- the local surveillance findings (e.g., the trends in the numbers of dead bird sightings or of virus-infected birds or mammals);
- the local vector distribution, vector density and species identification and mosquito infection rates of known or potential vector (mosquito) populations;
- evidence of WNV illness or mortality in the Health Unit jurisdiction, with consideration of the situation in adjacent jurisdictions;
- the trend in local human morbidity or mortality that indicates the relative urgency of the risk to human health;
- the demographic and geographic distribution of the human population at risk;
- the nature and location of the vector (mosquito) larval development site(s) to be treated, including the type of stagnant water, its proximity to human populations at risk and the ease of access for larvicide application;
- the time of season and local weather conditions (temperature, rainfall, winds);
- the relative effectiveness and safety of the pesticide product, as evaluated by federal authorities, and the regulatory requirements of provincial and federal authorities; and,
- community and stakeholders' attitudes towards the risks posed by the WNV versus the likely benefits and risks of larviciding or adulticiding in those locations identified by the risk assessment.
- consideration of the calculated vector index

Registration and Regulation of Pesticide Use in Canada

Federal and provincial regulations regarding the use of larvicides or adulticides, as for all other registered pesticides in Canada, must be followed.

For the provincial Ministry of the Environment regulations refer to www.ene.gov.on.ca. For the federal authority, please contact the Pest Management Regulatory Agency at 1-800-267-6315 or via their Health Canada website at: www.hc-sc.gc.ca/pmra-arla/english/index-e.html.

Larvicides

While there are several biological and chemical larvicides presently registered for use in Canada, the Ministry of the Environment is only authorizing three under approved permit. The use of *Bti* (*Bacillus thuringiensis israelensis*) and *Bacillus sphaericus* (*B. sphaericus*) is approved for use in surface waters such as stagnant water in irrigation ditches, flood ditches or pastures, marshes, woodland pools, standing ponds, or storm water retention and detention ponds. Methoprene and *B. sphaericus* are approved for use in catch basins and sewage and sludge lagoons for larval mosquito control to reduce the risk of WNV.

Bti and *B. sphaericus* are bacterial spores which are ingested by mosquito larva and release a crystallized toxin in the larva's stomach which causes damage to the larva's alkaline gut resulting in an inability to feed and subsequent death. Safety evaluation of *Bti* and *B. sphaericus* application for larval control have shown little or no risk to wildlife, non-target aquatic organisms or human health. PMRA has approved *Bti* and *B. sphaericus* for full registration. *Bti* and *B. sphaericus* must be applied when mosquito larvae are present in various mosquito larval development sites as indicated on the product labels.

Methoprene is an insect growth regulator which mimics the natural juvenile growth hormone in insect larvae. Methoprene does not kill mosquitoes; it prevents the development of larvae and pupae into adult mosquitoes which can potentially transmit WNV and other vector-borne diseases. Methoprene is applied to catch basins and sewage lagoons and must be applied before larvae pupate.

Methoprene, when used in the approved manner, is not expected to pose unreasonable risks to wildlife, people, or the environment. PMRA has approved the use of methoprene ingots under a temporary registration and has required that additional efficacy studies of the product be undertaken and submitted to PMRA.

For additional information on larvicides consult the Pest Management Regulatory Agency at 1-800-267-6315 or the agency website at www.hc-sc.gc.ca/pmra-arla/english/index-e.htm

Product labels can also be accessed through the search link on the PMRA web site.

The permit applicant guides and fact sheets are posted on the MOE web site at www.ene.gov.on.ca and are linked to the West Nile virus icon.

Larviciding Modes and Equipment

Two types of larviciding equipment may be used, for solid (granule or pellet) or liquid formulations. The equipment may be manually or power-operated, and hand or shoulder-carried, or can be mounted on All-Terrain Vehicles (ATVs), trucks or aircraft. All products must be applied by a licensed applicator.

Solid or “dry” larvicides may be applied directly by hand or from a tank (carried on the applicators back) that ejects the granules or pellets by means of a gravity-fed hopper, a manually-cranked dispenser, or a powered auger. These methods are useful for treating small areas (catch basins, ditches, or other containers or small bodies of water) around which the applicator can position himself or herself appropriately and dispense small amounts of larvicide.

Methoprene in a briquet (ingot) formulation and *B. sphaericus* in a water soluble pouch formulation must be placed through the grates of catch basins (or by lifting the grate) and are intended to slowly release the larvicide over a period of time.

For treating larger areas, powered backpack blowers may be used to spread granules farther away from the applicator, and these blowers can also be mounted on ATVs. Truck-mounted blowers are used, for example, to treat wide roadside ditches over a distance. Should very large areas need treatment, granule spreader systems can be mounted on fixed-wing or rotary (helicopter) aircraft.

Liquid larvicides (which are less commonly used) may be dispensed by a hand-held compressed-air sprayer or by a powered backpack sprayer. Like the powered granule blowers, these liquid sprayers may be mounted on ATVs or trucks to treat larger areas. Liquid larvicides are rarely applied by aerial means because liquid formulations do not penetrate heavy vegetation or wooded areas as well as solid formulations. Liquid formulations are often mixed with coarse sand and applied by helicopter or fixed-wing aircraft to allow the larvicide to penetrate the vegetation when large water bodies are treated.

Mechanical Means of Larval Control

There are also mechanical means of larval control. Some of these techniques have been site-tested, and include sonic devices (utilizing sound waves to disrupt larval development), and devices for the vacuuming or agitation of the standing water in containers (such as catch basins) to disrupt larval development.

Sonic Wave Treatment

One municipal experiment with sonic waves to destroy larval development demonstrated that the abundance of larvae in a catch basin was greatly reduced after treatment. However, in a few days, new larvae would hatch because the basin was open and the water in the catch basin remained.

The method, while effective in a very short frame of time, may be too labour intensive for practical application in a general municipal program. Nevertheless, it may be useful in selected circumstances where easy access is available to the catch basin or other holding container of relative size.

Screens

The application of fine mesh screens to the top of catch basins has proved to be an effective means to prevent mosquito entry into catch basins, particularly when installed early in the season to prevent the laying of eggs. In addition, even when eggs hatched and developed into adults, the adults could not get out of the catch basin area because of the screening.

The installation of the screen however, requires major consideration. If the screen is applied to the top of the catch basin it is relatively easy to fix to the grate and to clean frequently to prevent leaves and debris from causing flooding following rain or other water deposits on the surface. Top installation is not practical on street catch basins because they do not stand up to the wear from continual traffic.

A potential application on the street basin is beneath the grate, but installation requires labour intensive lifting of the grate, fixing of the screen to the bottom of the grate and replacement of the grate. Regular maintenance is also required to keep the screen clear of water pools which are ideal for some mosquito species to breed.

Thus, it appears that in selected situations, mostly on private property or remote municipal sites, screening may be applicable, but only with an effective maintenance schedule to ensure that no water collects.

Vacuuming of Catch Basins

Vacuuming of the water from a catch basin has proved to be effective in that it removed the standing water together with any larvae. However, the water soon re-accumulates and permits the reintroduction of mosquito larvae into the catch basin.

Drilling of Drainage Holes into the base of the Catch Basin

An experiment was conducted to drill holes in the bottom of the catch basin to drain any accumulated water to prevent egg-laying and larval development. The trials did not prove successful because the holes quickly became plugged with debris and began retaining water in the bottom of the catch basin. The drilling work was labour intensive and required specialized staff and equipment along with the lifting of the grate and providing of the protection for the workers on any traffic area.

Even if the drainage holes proved to be an effective relief to the accumulation of water, there was concern that the integrity of the catch basin's physical structure could compromise the safety of the street surface because of the potential weakening of the earth support beneath the catch basin and the inevitable settlement of the construction.

Adult Mosquito Control

Adult Mosquito Control – physical exclusion option

An often overlooked adult mosquito control measure is simple screening or the use of air curtains. The first type of exclusion is the use of metal or cloth meshing to completely control mosquito access through doors, windows and over beds. The second type of exclusion uses a fan operated to provide a continual flow of air directed at doorways to keep mosquito from flying through the otherwise open door.

Maintenance for both modes is critical – holes or spaces in the physical curtains or equipment (or power) failures will obviously permit mosquito access to the previously protected areas.

Adulticiding Option (also known as 'mosquito fogging')

A local risk assessment is an essential prerequisite in the decision-making regarding the need to adulticide and where and when to start an adulticiding program. The decision is guided by Table 1 in the *O. Reg. 199/03 - Control of West Nile Virus Regulation*, and where and when to adulticide may be identified in the risk assessment from those local conditions which present the most significant and immediate risk to public health. Adulticiding must be included as part of any assessment in order to consider the complete spectrum of control measures (refer to Appendix VII). While larval control programs, including larviciding are an important means of proactive prevention, nevertheless, adulticiding is an option in the control of WNV.

A component of the risk assessment is drawn from experiences in other jurisdictions that have provided information on the other measures of prevention or control that have either been tried and shown to be inadequate, or would clearly not be effective if instituted anew. Hence, the "*General Decision-Making Factors: Larviciding and Adulticiding*" on page 36, along with factors in Appendix VII should be considered.

Whether or not larviciding has already been done in a jurisdiction, the urgency of the threat to human health from mosquito-borne virus may dictate the need to adulticide as indicated by Table 1 in the *O. Reg. 199/03 - Control of West Nile Virus Regulation*. Since larviciding seeks to prevent the emergence of the next generation of mosquitoes, it will not immediately reduce the population of flying adults, a percentage of which will be carrying the virus and seeking blood meals.

Contingency Adulticiding

The MOHLTC has again made available to all Medical Officers of Health a contracted mosquito control service to adulticide with malathion within 48 hours notice in any Health Unit in Ontario.

This service is initiated at a request from the local Medical Officer of Health, and is cost-shared when called upon. Both truck-mounted and backpack ULV modes of malathion delivery are available to the local Medical Officer of Health.

Backpack ULV capacity was added for 2006 to service circumstances where an MOH wishes to focus direct adult mosquito control in a very tightly defined area as identified to be an imminent WNV threat through the risk assessment process.

Prior to ULV treatment commencing, it is essential that the service provider (or the requesting MOH) serve appropriate community notice as required by law, no sooner than 48 hours in advance or no more than seven days before.

Pest Management Regulatory Agency (PMRA)

The Pest Management Regulatory Agency has reviewed the currently registered malathion ULV adulticide for label improvements. Furthermore, PMRA has completed an occupational and bystander risk assessment for its use in community-wide mosquito control programs and concluded that the product when used according to label directions does not pose an unacceptable risk to bystanders or users.

For more information about specific adulticides, please contact the Pest Management Regulatory Agency by telephoning 1-800-267-6315 or via their Health Canada website at http://www.hc-sc.gc.ca/home-accueil/search-recherche/a_e.html

Monitoring the Effectiveness of Vector Control Measures

A more specific and immediate field evaluation of effectiveness for larviciding would be continued sampling of larvae before and after treatment. To determine the efficacy of *Bti* or *B. sphaericus* in preventing 4th instar larvae and pupal development the relative number of larvae collected before and after larviciding can be compared. The general aim of larviciding with *Bti* is to obtain 95% control within 24 hours of application after all

label directions have been followed and after 48 hours of larviciding with *B. sphaericus*. To determine the efficacy of methoprene in preventing the emergence of adult mosquitoes, the collection and rearing of live pupae to determine emergence inhibition rates is required.

Following adulticiding, the relative numbers of adult mosquitoes collected in light traps should be compared to the numbers collected immediately prior to the insecticide application and/or numbers collected in adjacent “untreated” areas.

Monitoring the frequency of local citizen complaints of mosquitoes or mosquito bites is less precise, but has been used as a more subjective method to evaluate nuisance control. Nevertheless, complaints could be used to determine the effectiveness of an agency’s treatment program, both larval and adult. There is some published information that the volume of complaints pre- and post-treatment gives a reliable indicator of the success or possible failure of the treatment over the entire treated area and the method may be beneficial when used along with other parameters to monitor the effectiveness of control measures.

Possible reasons for the “failure” of these control measures are varied. They may be related to incomplete consideration of the “*General Decision-Making Factors: Larviciding and Adulticiding*” described on page 36 or the factors noted in Appendix VII. It is acknowledged that the impacts of larviciding or adulticiding may be extremely dependent on many variables affecting local conditions (i. e. weather conditions, mosquito counts, proximity to residential areas, etc.).

Weather conditions, for example, influence both mosquito populations – their distribution (e.g. strong winds may blow mosquitoes in from outside the “control zone”) and the extent and rapidity of their breeding and development (high temperatures or humidity) – and the limitations of ULV application in controlling adult mosquitoes over large urban areas.

Since the issue of how well a vector management program has been implemented varies in different jurisdictions and at different times, it is difficult to make a generalization about the expected effectiveness of larviciding or adulticiding in preventing mosquito-borne virus transmission to humans or other host populations. The insecticide products, however, have been evaluated and approved for their general effectiveness in reducing mosquito populations when used according to the label.

Surveillance of Potential Adverse Health Effects from Pesticide Exposure

Objective

To monitor for possible adverse health effects that are attributable to larvicide or adulticide exposure.

Background

Since exposure to any pesticide has the potential to cause adverse reactions, each Health Unit is required to ensure, as a minimum, that the advance community adulticiding notification requirements of the Ministry of the Environment (MOE) are followed so that persons with pre-existing respiratory conditions (e.g. asthma) or sensitivities to pesticides have reasonable opportunity to take precautions to avoid or minimize exposure. The time period and methods of advance notification are found on the MOE website at www.ene.gov.on.ca/envision/land/westnile/index.htm

Under the Control of West Nile Virus Regulation (*O. Reg. 199/03*), Medical Officers of Health are to maintain a means to record, investigate and report to the MOHLTC any confirmed or likely adverse or unintended human health effects attributed to mosquito control actions, and will report any non-human environmental adverse effects that he/she knows about to the Ministry of the Environment and other relevant local or provincial authorities.

Planned Activities

As part of their active surveillance communications with local hospitals for WNV Illness, the Health Unit is asked to monitor for any reported cases of adverse health effects attributed to pesticide exposure from adulticiding or larviciding.

Following pesticide application, should persons indicate to the Medical Officer of Health that they are experiencing impact from control measures, the Health Unit may have to work with the MOE (District Office or regional pesticide specialist), the licensed exterminator, and/or municipal agencies involved in either the adulticiding/larviciding work or the local environmental monitoring, as well as with health care provider(s) in obtaining these persons' history of exposure in order to assess the nature or likelihood of any indicated exposure of affected persons. Appendix VI provides information on malathion to assist the Health Units in the investigation and reporting of potential malathion exposure in case it was used for the adult mosquito control. Also, Health Units are advised to make arrangements with the health care providers in their communities to ensure that this reporting is as complete and timely as possible.

IV. Ongoing Professional Communication and Collaboration on West Nile Virus Issues in North America

Objective

To better understand the ecology of WNV in Ontario and to assess the effectiveness of surveillance, prevention and control methods toward the reduction of WNV illness as well as ensure financial and program accountability.

Background

With WNV being considered endemic in North America, and given the large number of vectors in Ontario, it is necessary to routinely monitor the success of the work being undertaken across the province, including that done through larviciding toward the reduction of the WNV-prone vector population.

It is also necessary to maintain regular contact with colleagues throughout North America to ensure that we are current with the latest information on WNV surveillance and control.

Planned Activities

- The MOHLTC shall communicate with all Health Units through regular teleconferences.
- The MOHLTC e-mails information and materials on WNV matters to all Health Units regularly to share data and information of successes or problems.
- The MOHLTC will provide weekly WNV vector surveillance reports for Ontario to aid in local risk assessment responsibilities, and will provide Health Unit-specific analysis at the request of the local MOH.
- The MOHLTC is supportive of the epidemiologic analysis proposed by the CCWHC in conjunction with the Public Health Agency of Canada to evaluate the usefulness of selected indicators of WNV infection, including the utility of dead crow 'sightings' reports as a predictor of WNV activity.
- The MOHLTC is actively working with the Public Health Agency of Canada through WNV data-sharing for epidemiological analyses.