

**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*<sup>\*</sup> 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.

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<sup>\*</sup> 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.

## Table of Contents

<b>Preface</b>	<b>ii</b>
<b>Acknowledgements</b>	<b>iii</b>
<b>Executive Summary</b>	<b>1</b>
<b>I. Introduction</b>	<b>9</b>
<b>Background for West Nile Virus Illness</b>	<b>10</b>
<b>Public Health Roles in Ontario</b>	<b>11</b>
Health Units	11
Ministry of Health and Long-Term Care	12
<i><b>Public Education, Risk Communication and Community Outreach</b></i>	<b>13</b>
<b>Health Care Provider Outreach</b>	<b>13</b>
Public Education Activities within Local Health Unit Areas	14
Public	14
Local Source Reduction	15
<b>II. Surveillance Indicators</b>	<b>17</b>
<b>Major Host (Bird) Surveillance</b>	<b>17</b>
Objective	17
Background	17
Selection of Surveillance Species	17
Not a Survey of Bird Illness	17
Purpose of WNV-Avian Surveillance	17
Planned Activities	18
"Sightings" Reports	18
Undetermined Causes of Bird Death	19
Scheduling for Dead Bird Surveillance	20
Shipping Protocol	20
<b>Human Surveillance</b>	<b>21</b>
Objective	21
Background	21
Human Clinical Manifestations	21
Planned Activities	21
<b>Surveillance for West Nile Virus Illness (Case Definition)</b>	<b>22</b>
WNV Case Categories	22
Reportable Disease Requirements in Ontario	24
Modes of Transmission	24
Objective	27
Background	27
Extrinsic Incubation Period (EIP)	27
Secondary Vector (Mosquito) Surveillance for the virus of Eastern Equine Encephalitis (EEE)	29
Selection of Mosquito Testing Service Providers	29
Planned Activities	31

<b>Equine (Horse) Surveillance</b>	<b>33</b>
Objective	33
Background	33
Planned Activities	33
<b>III. West Nile Virus Prevention and Control</b>	<b>34</b>
<b>Vector (Mosquito) Management (Immatures and Adults)</b>	<b>34</b>
Objective	34
Background	34
Planned Activities	34
General Decision-Making Factors: Larviciding and Adulticiding	36
Registration and Regulation of Pesticide Use in Canada	36
Larvicides	37
Larviciding Modes and Equipment	38
Mechanical Means of Larval Control	38
Adult Mosquito Control	40
<b>Monitoring the Effectiveness of Vector Control Measures</b>	<b>41</b>
Objective	43
Background	43
Planned Activities	43
<b>IV. Ongoing Professional Communication and Collaboration on West Nile Virus Issues in North America</b>	<b>44</b>
Objective	44
Background	44
Planned Activities	44

<b>V. Appendices</b>	<b>45</b>
Appendix I (a) Human Surveillance Case Definition	46
Appendix I (b) Health Unit Notification to Central Public Health Lab	52
Appendix I (c) Health Unit Notification to Canadian Blood Services	53
Appendix I (d) Health Unit Notification to Trillium Gift of Life Network	54
Appendix I (e) Human Case Investigation Report for West Nile Virus	56
Appendix II (a) Health Unit Codes	65
Appendix II (b) Mosquito Species to be Identified and Reported	66
Appendix II (c) Mosquito Species Proven Positive for WNV, EEE or Dengue	67
Appendix II (d) WNV Mosquito Species Viral Testing Order of Preference	68
Appendix III The Handling and Submission of Avian Specimens	69
Appendix IV Mandatory Health Programs and Services Guidelines	75
Appendix V Ontario Regulation 199/03	77
Appendix VI (a) Summary Report: WNV Mosquito Control Malathion-Related Illness	79
Appendix VI (b) Malathion TOX Q & A Circular	81
Appendix VI (c) WNV Malathion Application: Human Exposure and Adverse Effects Incident Report	89
Appendix VII Factors for Consideration for Adult Mosquito Control through Ultra-Low Volume (ULV) Application	91

## **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 (3<sup>rd</sup> 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](http://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’<sup>†</sup>. 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.

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<sup>†</sup> 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](http://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](http://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<sup>‡</sup> document (see Appendix I).

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<sup>‡</sup> 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

<b>Illness Type</b>	<b>Category</b>	<b>Clinical Criteria</b>	<b>Laboratory Criteria</b>
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](http://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](http://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 CO<sub>2</sub> 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 CO<sub>2</sub>-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<sup>§</sup> 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.

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<sup>§</sup> 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](http://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](http://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](http://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](http://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](http://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](http://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](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 4<sup>th</sup> 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](http://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.

## V. Appendices

**Appendix I (a)**  
**Human Surveillance Case Definition**  
(Revised July 4, 2005)

**Section A: Case Definitions**

The current Case Definitions were drafted with available information at the time of writing. Case Definitions and Diagnostic Test Criteria are subject to change as new information becomes available.

**1) West Nile Virus Neurological Syndrome (WNNS):**

**Clinical Criteria:**

History of exposure in an area where WN virus (WNV) activity is occurring<sup>1</sup>

**OR**

history of exposure to an alternative mode of transmission<sup>2</sup>

**AND**

onset of fever

**AND NEW ONSET OF AT LEAST ONE of the following:**

- encephalitis (acute signs of central or peripheral neurologic dysfunction),  
or
- viral meningitis (pleocytosis and signs of infection e.g. headache, nuchal rigidity), or
- acute flaccid paralysis (e.g. poliomyelitis-like syndrome or Guillain-Barré-like syndrome)<sup>3</sup> or
- movement disorders (e.g., tremor, myoclonus) or
- Parkinsonism or Parkinsonia like conditions (e.g., cogwheel rigidity, bradykinesia, postural instability) or
- other neurological syndromes as defined in the note below

<sup>1</sup>History of exposure when and where West Nile virus transmission is present, or could be present, or history of travel to an area with confirmed WNV activity in birds, horses, other mammals, sentinel chickens, mosquitoes, or humans.

<sup>2</sup>Alternative modes of transmission, identified to date, include: laboratory-acquired; *in utero*; receipt of blood components; organ/tissue transplant; and, possibly via breast milk.

<sup>3</sup> A person with WNV-associated acute flaccid paralysis may present with or without fever or mental status changes. Altered mental status could range from confusion to coma with or without additional signs of brain dysfunction (e.g. paralysis, cranial nerve palsies, sensory deficits, abnormal reflexes, generalized convulsions and abnormal movements). Acute flaccid paralysis with respiratory failure is also a problem.

**Note:** A significant feature of West Nile viral neurologic illness may be marked muscle weakness that is more frequently unilateral, but could be bilateral. WNV should be considered in the differential diagnosis of all suspected cases of acute flaccid paralysis with or without sensory deficit. WNV-associated weakness typically affects one or more limbs (sometimes affecting one limb only). Muscle weakness may be the sole presenting feature of WNV illness (in the absence of other

neurologic features) or may develop in the setting of fever, altered reflexes, meningitis or encephalitis. Weakness typically develops early in the course of clinical infection. Patients should be carefully monitored for evolving weakness and in particular for acute neuromuscular respiratory failure, which is a severe manifestation associated with high morbidity and mortality.

**For the purpose of WNV Neurological Syndrome Classification, muscle weakness is characterized by severe (Polio-like), non-transient and prolonged symptoms.**

Electromyography (EMG) and lumbar puncture should be performed to differentiate WNV paralysis from the acute demyelinating polyneuropathy (Guillain-Barré syndrome). Lymphocytic pleocytosis (an increase in WBC with a predominance of lymphocytes in the cerebrospinal fluid [CSF]) is commonly seen in acute flaccid paralysis due to WNV.

Other emerging clinical syndromes, identified during 2002 included, but were not limited to the following: myelopathy, rhabdomyolysis (acute destruction of skeletal muscle cells), peripheral neuropathy; polyradiculoneuropathy; optic neuritis; and acute demyelinating encephalomyelitis (ADEM). Ophthalmologic conditions including chorioretinitis and vitritis were also reported. Facial weakness was also reported. Myocarditis, pancreatitis and fulminant hepatitis have not been identified in North America, but were reported in outbreaks of WNV in South Africa. "Aseptic" meningitis without encephalitis or flaccid paralysis occurring in August and September when WNV is circulating may be due to non-polio enteroviruses circulating at the same time. This should be considered in the differential diagnosis.

[Sejvar J et al. JAMA (2003) Vol.290 (4) p. 511-515, Sejvar, J. et al. Emerg Infect Dis (2003) Vol 9 (7) p.788-93 and Burton, JM et al Can. J. Neurol. Sci. (2004) Vol.31 (2) p.185-193]

### **Suspect WN Neurological Syndrome Case:**

Clinical criteria IN THE ABSENCE OF OR PENDING diagnostic test criteria (see below) AND IN THE ABSENCE of any other obvious cause.

### **Probable WN Neurological Syndrome Case:**

Clinical criteria AND AT LEAST ONE of the probable case diagnostic test criteria (see below).

### **Confirmed WN Neurological Syndrome Case:**

Clinical criteria AND AT LEAST ONE of the confirmed case diagnostic test criteria (see below).

## **2) West Nile Virus Non-Neurological Syndrome (WN Non-NS):**

### **Clinical Criteria:**

History of exposure in an area where WN virus (WNV) activity is occurring<sup>1</sup>

**OR**

History of exposure to an alternative mode of transmission<sup>2</sup>

**AND AT LEAST TWO** of the following<sup>4</sup>:

- fever,
- Myalgia<sup>5</sup>,
- arthralgia,
- headache,
- fatigue,
- lymphadenopathy,
- maculopapular rash

<sup>1</sup>History of exposure when and where West Nile virus transmission is present, or could be present, or history of travel to an area with confirmed WNV activity in birds, horses, other mammals, sentinel chickens, mosquitoes, or humans.

<sup>2</sup>Alternative modes of transmission, identified to date, include: laboratory-acquired; *in utero*; receipt of blood components; organ/tissue transplant; and, possibly via breast milk.

<sup>4</sup>It is possible that other clinical signs and symptoms could be identified that have not been listed and may accompany probable case or confirmed case diagnostic test criteria. For example, gastrointestinal (GI) symptoms were seen in many WNV patients in Canada and the USA in 2003 and 2004.

<sup>5</sup> Muscle weakness may be a presenting feature of WNV illness. **For the purpose of WNV Non-Neurological Syndrome classification, muscle weakness or myalgia (muscle aches and pains) is characterized by mild, transient, unlikely prolonged symptoms that are not caused by motor neuropathy.**

### **Suspect WN Non-Neurological Syndrome Case:**

Clinical criteria IN THE ABSENCE OF OR PENDING diagnostic test criteria (see below) AND IN THE ABSENCE of any other obvious cause.

### **Probable WN Non-Neurological Syndrome Case:**

Clinical criteria AND AT LEAST ONE of the probable case diagnostic test criteria (see below)

### **Confirmed WN Non-Neurological Syndrome Case:**

Clinical criteria AND AT LEAST ONE of the confirmed case diagnostic test criteria (see below)

## **3) West Nile Virus Asymptomatic Infection (WNAI)<sup>6</sup>:**

### **Probable WN Asymptomatic Infection Case:**

Probable case diagnostic test criteria (see below) IN THE ABSENCE of clinical criteria

### **Confirmed WN Asymptomatic Infection Case:**

Confirmed case diagnostic test criteria (see below) IN THE ABSENCE of clinical criteria

<sup>6</sup>This category could include asymptomatic blood donors whose blood is screened using a Nucleic Acid Amplification Test (NAT), by Blood Operators (i.e. Canadian Blood Services or Hema-Quebec) and is subsequently brought to the attention of public health officials. The NAT that will be used by Blood Operators in Canada is designed to detect all viruses in the Japanese encephalitis (JE) serocomplex. The JE serocomplex includes WN virus and 9 other viruses, although from this group only WN virus and St Louis encephalitis virus are currently endemic to parts of North America. Blood Operators in Canada perform a supplementary WN virus-specific NAT following any positive donor screen test result.

## **Section B: West Nile Virus Diagnostic Test Criteria:**

### **Probable Case Diagnostic Test Criteria:**

#### **AT LEAST ONE of the following:**

Detection of flavivirus antibodies in a single serum or CSF sample using a WN virus IgM ELISA <sup>7</sup> without confirmatory neutralization serology (e.g. Plaque Reduction Neutralization Test [PRNT]) <b>OR</b>
A 4-fold or greater change in flavivirus HI titres in paired acute and convalescent sera or demonstration of a seroconversion using a WN virus IgG ELISA <sup>7</sup> <b>OR</b>
A titre of $\geq 1:320$ in a single WN virus HI test, or an elevated titre in a WN virus IgG ELISA, with a confirmatory PRNT result <b>OR</b> [Note: A confirmatory PRNT or other kind of neutralization assay is not required in a health jurisdiction/authority where cases have already been confirmed in the current year]
Demonstration of Japanese encephalitis (JE) serocomplex-specific genomic sequences in blood by NAT screening on donor blood, by Blood Operators in Canada.

<sup>7</sup> Both CDC and commercial IgM / IgG ELISAs are now available for front line serological testing. Refer to appropriate assay procedures and kit inserts for the interpretation of test results.

**Note:** WNV IgM antibody may persist for more than a year and the demonstration of IgM antibodies in a patient's serum, particularly in residents of endemic areas, may not be diagnostic of an *acute* WN viral infection. Seroconversion (by HI, IgG ELISA or PRNT assays) demonstrates a current WNV infection. Therefore, the collection of acute and convalescent sera for serologic analysis is particularly important to rule out diagnostic misinterpretation early in the WNV season (e.g. May, June) and to identify initial cases in a specific jurisdiction. However, it should be noted that seroconversions may not always be documented due to timing of acute sample collection (i.e. titres in acute sera may have already peaked). If static titres are observed in acute and convalescent paired sera, it is still possible the case may represent a recent infection. To help resolve this, the use of IgG avidity testing <sup>8</sup> may be considered to distinguish between current and past infection. The presence of both IgM antibody and low avidity IgG in a patient's convalescent serum sample are consistent with current cases of viral associated illness. However test results that show the presence of IgM and high avidity IgG are indicative of exposures that have occurred in the previous season. Immunocompromised individuals may not be able to mount an immune response necessary for a serological diagnosis. West Nile virus diagnostic test criteria for these individuals should be discussed with a medical microbiologist.

<sup>8</sup> Early in infection the immune system generates antibodies that bind relatively weakly to viral antigen (low avidity). As the infection proceeds, an increasing percentage of newly generated IgG antibody displays higher binding affinity to virus antigen and thus avidity also rises (Note: avidity is usually measured based upon the ability of IgG to dissociate from antigen preparations)

after incubation with a solution of urea). As long as high avidity IgG is not yet detected in the serum it can be assumed that the individual was exposed to the viral agent during a recent exposure. With respect to WNV infection it has not been precisely determined when (i.e. post-exposure) high avidity antibodies reach levels in serum that can be accurately detected by serological assays (there may be significant variation depending on the individual). However, it has been shown that greater than 95% of sera collected from individuals exposed to WNV 6-8 months previously will have IgG antibodies that bind strongly to viral antigen and will give high avidity scores using both IFA and ELISA testing formats. **Note: Avidity testing will not replace confirmatory neutralization testing, non-WNV flavivirus IgG antibody (Eg. dengue, SLE, etc.) may bind to the antigen preparations used in avidity assays.**

**Confirmed Case Diagnostic Test Criteria:**

It is currently recommended that health jurisdictions/authorities use the Confirmed Case Diagnostic Test Criteria to confirm index cases (locally acquired) in their area each year; for subsequent cases, health jurisdictions/authorities could use the Probable Case Diagnostic Test Criteria to classify cases in their area as “confirmed”, **for the purposes of surveillance**. Throughout the remainder of the transmission season health jurisdictions/authorities may wish to document PRNT antibody titres to West Nile virus in a proportion of cases, to be determined by that health jurisdiction/authority, in order to rule-out the possibility of concurrent activity by other flaviviruses. [For further information on diagnostic testing algorithms for West Nile virus, see the section entitled Laboratory Specimen Diagnostic Testing Algorithm in Appendix 4 of the National Guidelines for Response to West Nile virus.]

**AT LEAST ONE of the following:**

A 4-fold or greater change in WN virus neutralizing antibody titres (using a PRNT or other kind of neutralization assay) in paired acute and convalescent sera, or CSF. <b>OR</b>
Isolation of WN virus from, or demonstration of WN virus antigen or WN virus-specific genomic sequences in tissue, blood, CSF or other body fluids <b>OR</b>
Demonstration of flavivirus antibodies in a single serum or CSF sample using a WN virus IgM ELISA <sup>7,8</sup> , confirmed by the detection of WN virus specific antibodies using a PRNT (acute or convalescent specimen). <b>OR</b>
A 4-fold or greater change in flavivirus HI titres in paired acute and convalescent sera or demonstration of a seroconversion using a WN virus IgG ELISA <sup>7,8</sup> <b>AND</b> the detection of WN specific antibodies using a PRNT (acute or convalescent serum sample).

<sup>7</sup> Both CDC and commercial IgM / IgG ELISAs are now available for front line serological testing. Refer to appropriate assay procedures and kit inserts for the interpretation of test results.

**Note:** WNV IgM antibody may persist for more than a year and the demonstration of IgM antibodies in a patient's serum, particularly in residents of endemic areas, may not be diagnostic of an *acute* WNV viral infection. Seroconversion (by HI, IgG ELISA or PRNT assays) demonstrates a current WNV infection. Therefore, the collection of acute and convalescent sera for serologic analysis is particularly important to rule out diagnostic misinterpretation early in the WNV season (e.g. May, June) and to identify initial cases in a specific jurisdiction. However, it should be noted that seroconversions may not always be documented due to timing of acute sample collection (i.e. titres in acute sera may have already peaked). If static titres are observed in acute and convalescent paired sera, it is still possible the case may represent a recent infection. To help resolve this, the use of IgG avidity testing<sup>9</sup> may be considered to distinguish between current and past infection. The presence of both IgM antibody and low avidity IgG in a patient's convalescent serum sample are consistent with current cases of viral associated illness. However test results that show the presence of IgM and high avidity IgG are indicative of exposures that have occurred in the previous season. Immunocompromised individuals may not be able to mount an immune response necessary for a serological diagnosis. West Nile virus diagnostic test criteria for these individuals should be discussed with a medical microbiologist.

<sup>8</sup> Early in infection the immune system generates antibodies that bind relatively weakly to viral antigen (low avidity). As the infection proceeds, an increasing percentage of newly generated IgG antibody displays higher binding affinity to virus antigen and thus avidity also rises (Note: avidity is usually measured based upon the ability of IgG to dissociate from antigen preparations after incubation with a solution of urea). As long as high avidity IgG is not yet detected in the serum it can be assumed that the individual was exposed to the viral agent during a recent exposure. With respect to WNV infection it has not been precisely determined when (i.e. post-exposure) high avidity antibodies reach levels in serum that can be accurately detected by serological assays (there may be significant variation depending on the individual). However, it has been shown that greater than 95% of sera collected from individuals exposed to WNV 6-8 months previously will have IgG antibodies that bind strongly to viral antigen and will give high avidity scores using both IFA and ELISA testing formats. **Note: Avidity testing will not replace confirmatory neutralization testing, non-WNV flavivirus IgG antibody (Eg. dengue, SLE, etc.) may bind to the antigen preparations used in avidity assays.**

## Appendix I (b) Health Unit Notification to Central Public Health Lab

Ministry of Health  
and  
Long-Term Care

Ministère de la Santé  
et  
des Soins de longue  
durée



### FAX: FROM HEALTH UNITS TO CPHL Version April 24, 2007

<b>TO:</b>		Tina Di Persiis/Christina Vecchiato		Date : <input style="width: 50px;" type="text"/>	
<b>ORGANIZATION:</b>		W.R.A.P.S. DEPARTMENT			
<b>FAX #:</b>		416-235-6188		<b>PHONE #:</b> 416-235-6071 416-235-6092	
<b>FROM:</b>		<input style="width: 100%;" type="text"/>			
<b>ORGANIZATION/DEPT.:</b>		<input style="width: 100%;" type="text"/>			
<b>ADDRESS:</b>		<input style="width: 100%;" type="text"/>			
<b>PAGES:</b>		<input style="width: 50px;" type="text"/> <b>PHONE #</b> <input style="width: 50px;" type="text"/>		<b>FAX #:</b> <input style="width: 50px;" type="text"/>	
<b>CONFIDENTIAL</b> <input type="checkbox"/>		<b>AS REQUESTED</b> <input type="checkbox"/>		<b>PER CONVERSATION</b> <input type="checkbox"/>	
<b>URGENT</b> <input type="checkbox"/>		<b>FYI</b> <input type="checkbox"/>		<b>PER E-MAIL NOTE</b> <input type="checkbox"/>	

**REQUEST FOR INFORMATION on West Nile Virus (WNV):**

As per the preceding phone call informing you of this fax, the following individual

is not a resident of this health unit, and has been forwarded to:  
     Health Unit       Contact

is a suspect case - request ELISA test results

has a travel history - request confirmation by PRNT

is possibly not a recently infected case - request Avidity testing

Name:       Test Result:

DOB:

Health card No:

Name of referring physician:

Please return results to sender when available.

**Confidentiality Notice:** The contents of the document(s) accompanying this facsimile transmission are confidential and intended only for the use of the individual(s) named above. If you have received this information in error, please notify me immediately by telephone at the above number

## Appendix I (c) Health Unit Notification to Canadian Blood Services

### WEST NILE VIRUS HUMAN CASE NOTIFICATION FAX TO CANADIAN BLOOD SERVICES

Version: March 30, 2006

Instructions: Please call the contact from your local CBS Centres in Ontario (list below) and then send this fax sheet.

**Hamilton:** Blood Product Management 24/7: 905-645-6558 Fax: 905-540-5800  
**London:** Jonni-Lyn Van Deursen: 519-690-3926 Fax: 519-690-3960  
**Toronto:** Blood Product Management 24/7: 416-313-4690 Fax: 416-974-9424  
**Ottawa (and North East):** Blood Product Management 24/7: 613-560-7212 Fax: 613-560-7199

To: \_\_\_\_\_ Date: \_\_\_\_\_  
 Phone: \_\_\_\_\_ Fax: \_\_\_\_\_  
 From: \_\_\_\_\_  
 Phone: \_\_\_\_\_ After-Hours: \_\_\_\_\_  
 Fax: \_\_\_\_\_ Health Unit: \_\_\_\_\_

<b>PATIENT INFORMATION:</b>	
Last Name: _____	First Name: _____
Middle Name: _____	Sex: <input type="checkbox"/> Male <input type="checkbox"/> Female
Date of Birth ____/____/____ (dd/mmm/yyyy)	
Date of First Symptoms ____/____/____ (dd/mmm/yyyy)	

<b>DONATION/RECEIPT INFORMATION:</b>
Case is a Blood Donor <input type="checkbox"/> Yes <input type="checkbox"/> No <input type="checkbox"/> Unknown
Date of Previous Blood Donation ____/____/____ (dd/mmm/yyyy)
Location of Previous Blood Donation _____
Case is a Blood Recipient <input type="checkbox"/> Yes <input type="checkbox"/> No <input type="checkbox"/> Unknown
Date of Previous Blood Transfusion ____/____/____ (dd/mmm/yyyy)
Location of Previous Blood Transfusion _____
Other (please specify) _____



Canadian Blood Services  
Soci t  canadienne du sang

## Appendix I (d) Health Unit Notification to Trillium Gift of Life Network

### Reporting of West Nile Virus Viremia or Antibody Response Results to Trillium Gift of Life Network



April 6, 2006

#### **BACKGROUND:**

1. Transplant programs are often unaware of the origin of cadaveric organ or tissue donations, and donor hospitals are often unaware of the ultimate destination of cadaveric organ or tissue donations. As a result, direct notification of transplant programs regarding positive results in donors, or donor hospitals regarding positive results in recipients without the involvement of TGLN or the tissue bank concerned is not feasible.
2. Health Canada's Guidance Document on Basic Safety Requirements for Human Cells, Tissues and Organs for Transplantation (which organ donation organizations such as TGLN, tissue banks and transplant programs are required to comply with) states the following regarding Notification: "Positive or reactive transmissible disease test results, either confirmed or discordant, obtained from either a living or deceased donor shall be reported to the appropriate health authorities in accordance with federal, provincial, and territorial requirements. Positive, reactive or discordant test results shall be immediately reported to all organ donation organizations, tissue and cell banks and transplant programs in receipt of cells, tissues or organs from the donor. Living donors shall be notified of all confirmed positive results. For deceased donors, the donor program shall inform the donor's physician of record prior to death, or the physician who signed the death certificate, of confirmed positive test results."
3. Primary responsibility for the decision as to whether donated (nonperfused) tissues are suitable for transplantation rests with the tissue bank concerned. Primary responsibility for the decision as to whether donated organs (whether from a living or deceased donor) rests with the transplant program concerned.

## NOTIFICATION PROTOCOL:

### NONPERFUSED TISSUE

donors: Trillium Gift of Life Network AND medical director of tissue bank(s) which received tissue (if known) AND physician(s) most responsible for the donor during their hospital course

recipients: Trillium Gift of Life Network AND medical director of the tissue bank which provided tissue AND transplanting surgeon

### CADAVERIC ORGAN DONORS

donors: Trillium Gift of Life Network AND physician(s) most responsible for the donor during their hospital course

recipients: Trillium Gift of Life Network AND transplanting surgeon

### LIVE ORGAN DONORS

donors: procuring surgeon AND transplanting surgeon

recipients: procuring surgeon AND transplanting surgeon

Notifications as per above directed to Trillium Gift of Life Network may be addressed to:

Dr. Cameron Guest  
Chief Medical Officer  
Trillium Gift of Life Network

He is to be contacted by any of the means below:

main	416 363 4001
private	416 619 2307
fax	416 363 4002
e-mail	<a href="mailto:cameron.guest@giftoflife.on.ca">cameron.guest@giftoflife.on.ca</a>
Kathy Gilchrist	416 619 2311

# Appendix I (e) Human Case Investigation Report for West Nile Virus

Version: May 1, 2007

Ministry of Health  
and Long-Term Care

Ministère de la Santé  
et des Soins de longue durée



## Instructions

The following questionnaire is for Public Health Unit use only. It is to be used as a guide for entering West Nile virus case data into the integrated Public Health Information System (iPHIS). No part of this questionnaire is to be sent to the Ministry of Health and Long-Term Care (MOHLTC).

Health Units are requested to report all cases who are potential blood, plasma, and/or tissue/organ donors or recipients to their closest Canadian Blood Service branch.

## STATUS

Date Initial Action Taken: \_\_\_\_\_

Date Discharged from Follow-up: \_\_\_\_\_

Discharged By : \_\_\_\_\_



**3. BLOOD OR ORGAN DONOR, OR RECIPIENT OF BLOOD COMPONENT OR ORGAN/TISSUE TRANSPLANT:** (Information from the case-patient and/or health care provider) **Note that this screen must be accessed through the Outbreak Module, under the “client” heading.**

<b>In the 8 weeks before onset of symptoms, and up to today, have you/has the patient:</b>	<b>Yes</b>
<b>Donated/received blood, plasma or blood components?</b>	<input type="checkbox"/>
<b>if Yes, please specify:      Date: ____/____/____ ( yyyy-mm-dd)</b> <b>Hospital/Clinic/Physician _____</b> <b>City _____                      Prov/Terr _____</b>	
<b>Donated/received organs or tissues?</b>	<input type="checkbox"/>
<b>if Yes, please specify:      Date: ____/____/____ ( yyyy-mm-dd)</b> <b>Hospital/Clinic/Physician _____</b> <b>City _____                      Prov/Terr _____</b>	
<i>If the respondent replied YES to any of the above questions regarding blood donation/transfusion, has a representative of (1)Canadian Blood Services or (2)Hema-Quebec been notified?</i>  <i>If the respondent replied YES to any of the above questions regarding organ transplant, has the hospital where the transplant occurred been notified?</i>	<input type="checkbox"/>
<b>if Yes, please specify contact information:      Date ____/____/____ (yyyy-mm-dd)</b>  <b>Last Name: _____      First Name: _____</b> <b>Telephone: ____ - ____ - _____</b>	

**PART B. CASE INFORMATION**

**1. CASE CLASSIFICATION:**

Please see the “Ontario WNV Human Case Definition: Version July 4, 2005” for definitions of a Suspect, Probable and Confirmed case of WNV.

Person Under Investigation       Suspect       Probable       Confirmed       Does Not Meet

**2. SYNDROME TYPE (WNNS, WN NON-NS OR WNAI):**

Please select the appropriate syndrome type listed under the ‘Aetiologic Agent’ dropdown list. The available choices are:

- |                                    |   |
|------------------------------------|---|
| 1. WN NON-NS                       | (West Nile Virus Non-Neurological Syndrome) |
| 2. WNNS - Neurologic complications | (West Nile Virus Neurological Syndrome)     |
| 3. WNAI – Asymptomatic             | (West Nile Virus Asymptomatic Infection)    |

### **3. EXPOSURE INFORMATION**

If multiple exposures are entered, please identify the most probable exposure in your list by checking it off. Also, if exact exposure dates are unknown, to calculate the earliest exposure date subtract 15 days from the onset of symptoms.

#### **A. iPHIS Exposure Naming Convention:**

{Exposure Location Name} – {Item} – {Earliest Exposure Date}

Example 1 - the exposure is a mosquito bite at home in 'A-town' when date of onset was August 16, 2005:

- **Home A-town – Mosquito – 2005/08/01**

Example 2 – the exposure is a mosquito bite while camping in 'B-park' when date of onset was August 30, 2005:

- **Park B-park – Mosquito – 2005/08/15**

Example 3 - the exposure is a mosquito bite while traveling in USA State X when date of onset was July 25, 2005:

- **Travel USA State X – Mosquito – 2005/07/10**

#### **B. Exposure history in 3 weeks prior to symptom onset date:**

**Exposure 1: iPHIS Exposure Name** \_\_\_\_\_

##### **Most Likely Source**

Earliest Exposure Date _____/____/____ (yyyy-mm-dd)	Most Recent Exposure Date _____/____/____ (yyyy-mm-dd)
---	--

##### **Exposure Address**

Street Number	Street Name
Street Type	Street Direction
Unit	City
Postal Code	
Latitude*	Longitude*

##### **Setting/Travel Location Description Details**

Exposure Setting	Exposure Setting Type
Exposure Location Name	

##### **Comments**


**Exposure 2: iPHIS Exposure Name** \_\_\_\_\_

**Most Likely Source**

Earliest Exposure Date _____/____/____ (yyyy-mm-dd)	Most Recent Exposure Date _____/____/____ (yyyy-mm-dd)
---	--

**Exposure Address**

Street Number	Street Name
Street Type	Street Direction
Unit	City
Postal Code	
Latitude*	Longitude*

**Setting/Travel Location Description Details**

Exposure Setting	Exposure Setting Type
Exposure Location Name	

**Comments**


\*GIS coding can currently be placed in the UTM field or in the Address Comment field.

**4. INTERVENTIONS/TREATMENTS:** (Information from the case-patient)

**Hospitalization:**

1. Hospital name \_\_\_\_\_

Date of admission \_\_\_\_\_/\_\_\_\_/\_\_\_\_ (yyyy-mm-dd) Date of discharge \_\_\_\_\_/\_\_\_\_/\_\_\_\_ (yyyy-mm-dd)

2. Hospital name \_\_\_\_\_

Date of admission \_\_\_\_\_/\_\_\_\_/\_\_\_\_ (yyyy-mm-dd) Date of discharge \_\_\_\_\_/\_\_\_\_/\_\_\_\_ (yyyy-mm-dd)

**5. OUTCOME**

**Outcome of the case is to be completed upon initial investigation.**

Recovered

Pending

Ill

Residual

Effects  Fatal

Unknown

Outcome Date: \_\_\_\_\_/\_\_\_\_/\_\_\_\_ (yyyy-mm-dd)  Accurate

## 6. SIGNS AND SYMPTOMS

*Note: This page may be utilized as a fax to gather symptom information from the appropriate health care provider. Please note that if Yes is checked off for a symptom, a start date must also be entered for that symptom. The Onset Date is to be checked off only for the one symptom that most likely represents the start of the illness.*

CASE NAME (if page used as fax): \_\_\_\_\_

Patient Signs and Symptoms	Yes	No	Refused	Not Asked	Don't Know	Start Date	End Date	Onset Date*
Asymptomatic	<input type="checkbox"/>	___/___/___	___/___/___	<input type="checkbox"/>				
Confusion or unusual forgetfulness	<input type="checkbox"/>	___/___/___	___/___/___	<input type="checkbox"/>				
Diarrhea	<input type="checkbox"/>	___/___/___	___/___/___	<input type="checkbox"/>				
Facial muscle weakness	<input type="checkbox"/>	___/___/___	___/___/___	<input type="checkbox"/>				
Fatigue/sleepiness	<input type="checkbox"/>	___/___/___	___/___/___	<input type="checkbox"/>				
Fever (38°C or 100°F)	<input type="checkbox"/>	___/___/___	___/___/___	<input type="checkbox"/>				
Headache	<input type="checkbox"/>	___/___/___	___/___/___	<input type="checkbox"/>				
Joint pain	<input type="checkbox"/>	___/___/___	___/___/___	<input type="checkbox"/>				
Lymph nodes swelling/pain	<input type="checkbox"/>	___/___/___	___/___/___	<input type="checkbox"/>				
Malaise (general unwell feeling)	<input type="checkbox"/>	___/___/___	___/___/___	<input type="checkbox"/>				
Muscle pain (myalgia)	<input type="checkbox"/>	___/___/___	___/___/___	<input type="checkbox"/>				
Muscle weakness	<input type="checkbox"/>	___/___/___	___/___/___	<input type="checkbox"/>				
Nausea	<input type="checkbox"/>	___/___/___	___/___/___	<input type="checkbox"/>				
Neck, stiff	<input type="checkbox"/>	___/___/___	___/___/___	<input type="checkbox"/>				
Photophobia (eyes sensitive to light)	<input type="checkbox"/>	___/___/___	___/___/___	<input type="checkbox"/>				
Rash	<input type="checkbox"/>	___/___/___	___/___/___	<input type="checkbox"/>				
Vision, blurred/double	<input type="checkbox"/>	___/___/___	___/___/___	<input type="checkbox"/>				
Vision, deteriorating	<input type="checkbox"/>	___/___/___	___/___/___	<input type="checkbox"/>				
Vomiting	<input type="checkbox"/>	___/___/___	___/___/___	<input type="checkbox"/>				
Other	<input type="checkbox"/>	___/___/___	___/___/___	<input type="checkbox"/>				

\*Please specify one symptom as the client's Onset Date.

NOTES: \_\_\_\_\_  
 \_\_\_\_\_

PLEASE RETURN FAX TO:

HEATH UNIT: \_\_\_\_\_ FAX: \_\_\_\_\_

**7. COMPLICATIONS:**

*Note: This page may be utilized as a fax to gather complication information from the appropriate health care provider. (Complications are not listed in alphabetical order as in iPHIS, but are grouped to facilitate completion by health care provider.)*

CASE NAME (if page used as fax): \_\_\_\_\_

West Nile virus-related Neurological Syndromes:	Yes	Start Date	End Date
None	<input type="checkbox"/>	___/___/___	___/___/___
Acute demyelinating encephalomyelitis (ADEM)	<input type="checkbox"/>	___/___/___	___/___/___
Acute Flaccid Paralysis: Poliomyelitis-like Syndrome	<input type="checkbox"/>	___/___/___	___/___/___
Acute Flaccid Paralysis: Guillain Barré-like Syndrome (GBS)	<input type="checkbox"/>	___/___/___	___/___/___
Acute Flaccid Paralysis, other	<input type="checkbox"/>	___/___/___	___/___/___
Paralysis, other	<input type="checkbox"/>	___/___/___	___/___/___
Blindness	<input type="checkbox"/>	___/___/___	___/___/___
Optic neuritis	<input type="checkbox"/>	___/___/___	___/___/___
Encephalitis	<input type="checkbox"/>	___/___/___	___/___/___
Meningitis	<input type="checkbox"/>	___/___/___	___/___/___
Seizures	<input type="checkbox"/>	___/___/___	___/___/___
Movement disorders (e.g. tremors, myoclonus)	<input type="checkbox"/>	___/___/___	___/___/___
Parkinsonism (e.g. cogwheel rigidity, bradykinesia, postural instability)	<input type="checkbox"/>	___/___/___	___/___/___
Peripheral neuropathy	<input type="checkbox"/>	___/___/___	___/___/___
Polyradiculopathy	<input type="checkbox"/>	___/___/___	___/___/___
Rhabdomyolysis	<input type="checkbox"/>	___/___/___	___/___/___
Unknown	<input type="checkbox"/>	___/___/___	___/___/___
Other	<input type="checkbox"/>	___/___/___	___/___/___

NOTES: \_\_\_\_\_  
 \_\_\_\_\_  
 \_\_\_\_\_

**PLEASE RETURN FAX TO:**

HEALTH UNIT: \_\_\_\_\_ FAX: \_\_\_\_\_

**8. RISKS – BEHAVIOURAL SOCIAL FACTORS:**

**Personal Protective Measures:**

Case uses personal insect repellent(s) containing DEET when outside/outdoors?

- Never    Sometimes    Most of the time    Always    Not Asked    Unknown

Case uses other personal insect repellent(s) when outside/outdoors?

- Yes    No    Not Asked    Unknown

**Vaccination:**

Case has been vaccinated for a flavivirus (i.e. Japanese Encephalitis virus, Yellow Fever virus)

- Yes    No    Not Asked    Unknown

**Exposure:**

Case traveled more than 3 km from their residence in the three weeks prior to onset of symptoms?

- Yes    No    Not Asked    Unknown

Case is a Travel Case – Outside of Health Unit, within Ontario

- Yes    No    Not Asked    Unknown

Case is a Travel Case – Outside of Ontario

- Yes    No    Not Asked    Unknown

**9. LABORATORY TEST RESULTS:** (Information provided by the Central Public Health Laboratory)

Requisition	Sample Type (specify): Serum, CSF, or brain tissue	Collection Date (yy/mm/dd)	IgM ELISA Result	IgG ELISA Result	Nucleic Acid Test Results (e.g. PCR)	PRNT Titre	Other Test Result	Test Date (yy/mm/dd)

## Appendix II (a) Health Unit Codes

<b>Health Unit Code</b>	<b>Health Unit</b>	<b>Health Unit Code</b>	<b>Health Unit</b>
ALG	Algoma District	MSL	Middlesex-London
BRN	Brant County	NIA	Niagara Regional Area
CHK	Chatham-Kent	NPS	North Bay Parry Sound District
HAM	Hamilton	NWR	Northwestern
OTT	Ottawa	OXF	Oxford County
TOR	Toronto	PEE	Peel Regional
DUR	Durham Regional	PDH	Perth District
EOH	Eastern Ontario	PTC	Peterborough County
ELG	Elgin-St. Thomas	PQP	Porcupine
GBO	Grey Bruce	REN	Renfrew County and District
HDN	Haldimand-Norfolk	SMD	Simcoe Muskoka District
HKP	Haliburton-Kawartha-Pine Ridge District	SUD	Sudbury and District
HAL	Halton Regional	THB	Thunder Bay District
HPE	Hastings and Prince Edward Counties	TSK	Timiskaming
HUR	Huron County	WAT	Waterloo
KFL	Kingston-Frontenac And Lennox and Addington	WDG	Wellington-Dufferin-Guelph
LAM	Lambton	WEC	Windsor-Essex County
LGL	Leeds-Grenville and Lanark District	YRK	York Regional

**Appendix II (b)**  
**Mosquito Species to be Identified and Reported**

<b>Mosquito Species for Identification</b>
<i>Aedes cinereus</i>
<i>Aedes vexans nipponi</i>
<i>Aedes vexans vexans</i>
<i>Aedes / Ochlerotatus species</i>
<i>Anopheles punctipennis</i>
<i>Anopheles quadrimaculatus</i>
<i>Anopheles quadrimaculatus / walkeri</i>
<i>Anopheles walkeri</i>
<i>Anopheles species</i>
<i>Coquillettidia perturbans</i>
<i>Culiseta melanura</i>
<i>Culiseta morsitans</i>
<i>Culex pipiens</i>
<i>Culex pipiens/restuans</i>
<i>Culex restuans</i>
<i>Culex salinarius</i>
<i>Culex tarsalis</i>
<i>Culex species</i>
<i>Ochlerotatus black legged</i>
<i>Ochlerotatus broad-banded</i>
<i>Ochlerotatus canadensis</i>
<i>Ochlerotatus cantator</i>
<i>Ochlerotatus excrucians</i>
<i>Ochlerotatus hendersoni</i>
<i>Ochlerotatus japonicus</i>
<i>Ochlerotatus provocans</i>
<i>Ochlerotatus sollicitans</i>
<i>Ochlerotatus stimulans</i>
<i>Ochlerotatus triseriatus</i>
<i>Ochlerotatus triseriatus/hendersoni</i>
<i>Ochlerotatus trivittatus</i>
<i>Stegomyia albopicta (Aedes albopictus)</i>

Revised April 19, 2007

## Appendix II (c)

### Mosquito Species Proven Positive for WNV, EEE or Dengue

Funding for additional viral testing may be negotiated with the MOHLTC on a case-by-case basis of demonstrated need for more viral testing.

Changes to this listing will be made as required based upon new information.

<b>Mosquito Species for Viral Testing</b>
<i>Aedes vexans nipponii</i> (WNV)
<i>Aedes vexans vexans</i> (WNV) (EEE)
<i>Anopheles punctipennis</i> (WNV)
<i>Anopheles quadrimaculatus</i> (WNV)
<i>Anopheles walkeri</i> (WNV)
<i>Coquillettidia perturbans</i> (WNV) (EEE)
<i>Culex pipiens</i> (WNV)
<i>Culex quinquefasciatus</i> (WNV)
<i>Culex restuans</i> (WNV)
<i>Culex salinarius</i> (WNV) (EEE)
<i>Culex tarsalis</i> (WNV)
<i>Culiseta melanura</i> (EEE)
<i>Ochlerotatus broadbanded</i> (WNV)
<i>Ochlerotatus canadensis</i> (EEE)
<i>Ochlerotatus cantator</i> (WNV)
<i>Ochlerotatus hendersoni</i> (WNV)
<i>Ochlerotatus japonicus</i> (WNV)
<i>Ochlerotatus sollicitans</i> (WNV)
<i>Ochlerotatus stimulans</i> (WNV)
<i>Ochlerotatus triseriatus</i> (WNV)
<i>Ochlerotatus trivittatus</i> (WNV)
<i>Stegomyia albopicta</i> ( <i>Aedes albopictus</i> ) (WNV) (EEE) (DEN)

Revised April 21, 2006

## Appendix II (d)

### WNV Mosquito Species Viral Testing Order of Preference

The following table list WNV vector species of concern in Ontario. These species are listed in order of preference when considering what species to test in the event that a trap contains more than three different vectors.

	<b>Mosquito Species for Viral Testing</b>
1	<i>Culex pipiens</i>
2	<i>Culex restuans</i>
3	<i>Aedes vexans vexans/ Aedes vexans nipponi</i>
4	<i>Culex salinarius</i>
5	<i>Ochlerotatus triseriatus</i>
6	<i>Anopheles punctipennis</i>
7	<i>Ochlerotatus trivittatus</i>
8	<i>Anopheles walkeri</i>
9	<i>Ochlerotatus stimulans</i>
10	<i>Anopheles quadrimaculatus</i>
11	<i>Ochlerotatus canadensis</i>
12	<i>Coquillettidia perturbans</i>
*	<i>Ochlerotatus japonicus</i>
*	<i>Culex tarsalis</i>
*	<i>Aedes albopictus (Stegomyia albopicta)</i>

Revised April 13, 2007

\* Since these species are found in very low numbers and they are highly competent vectors, it is suggested that these be tested for WNV in addition to the three pool limit. The additional cost for such testing will be borne by the MOHLTC.

- This list is prepared based upon analysis of entomological data of Ontario and other variables. Changes to this list will be made as required based upon new information and analysis of entomological data of the province.

## Appendix III

# The Handling and Submission of Avian Specimens

ONTARIO WEST NILE VIRUS RESPONSE - 2007  
CCWHC Ontario/Nunavut – April 2007

### **RESPONSE TO A SICK OR DEAD BIRD**

Health Units need to develop local plans for a timely response to reports of sick or dead birds. This response should incorporate 4 steps, described below. First contact with the person finding sick or dead birds normally will be by Health Unit personnel manning telephones. Those employees should be made aware of the organization of the program locally, and be informed about how to deal with calls about dead birds. A protocol needs to be in place for the collection and submission of carcasses to CCWHC. Pick-up and submission of birds may be by Health Unit personnel or by others contracted locally to carry out nuisance or dead animal response. **All persons taking decisions regarding response and submission, and those handling and submitting dead birds, must be familiar with this document.**

1. The person receiving a call records: date of call, identity/contacts of caller, species involved (if known), condition of carcass(es), and exact location. Based on that information and criteria described below (species, carcass condition, number of birds sick or dead) decide whether the bird should/can/will be picked up, and if possible, inform caller of that decision. **This person will need to try to determine if the bird involved is a species of concern for WNV surveillance, specifically a crow, blue jay or raven** (see next section re Species of Particular Concern for questions to ask). If the bird can't/won't be picked up due to it not being a species of concern for WNV surveillance, inform the caller of the option of calling the CCWHC Call Centre (**1-866-673 4781 toll-free**). Otherwise, inform them of the means of carcass disposal appropriate in your jurisdiction (see below).
2. Dispatch, as soon as possible, person responsible for pick-up of bird, if appropriate based on decision in 1.
3. Collection of dead bird: the person doing so completes the CCWHC Incident Report Form based on direct identification of species and local observations. A decision is made re suitability for submission, based on informed knowledge of species, condition/appearance of carcass and circumstances of mortality. If the bird is not suitable for submission, retrieve and dispose of appropriately.
4. Submit suitable carcass to CCWHC lab, as described below, accompanied by a CCWHC Incident Report Form (sent to Health Units in April).

### **SPECIES OF PARTICULAR CONCERN FOR WNV SURVEILLANCE:**

**Submit carcasses of Corvidae (crows, blue jays and ravens) that are suitable for examination.**

#### **Corvidae**

In southern Ontario, the crow and blue jay are the species of concern for WNV surveillance

**Crows:** - colour - completely black, with black bill and black eyes.

- size - fledged young and adults are large birds; up to 45 cm (18") long from tip of bill to tip of tail; one to one and a half times as long as a large man's shoe.

**Blue Jay:** - colour: blue and gray with white and black markings, and a small crest on the head  
- fledged young and adults are medium-sized; up to 28 cm (11") long, a little shorter than a man's shoe

In northern Ontario, add the raven

**Ravens:** - like a large crow, up to 60 cm (24") long (length of 2 large man's shoes) and totally black, with a heavy straight bill

**'Confusing' species:** Species that are black, iridescent dark gray or dark brown in colour (starling, cowbird, blackbird, grackle, pigeon, mourning dove), and hence might be mistaken for crows or ravens, are all much smaller (none larger than 30 cm [12"], the size of a large man's shoe), none are jet black overall, and many have a light coloured white, yellow or red eye.

#### **OTHER SPECIES OF BIRDS AND MAMMALS**

CCWHC also carries out surveillance for diseases other than WNV in all species of wildlife. Please submit the following specimens for autopsy, if they are brought to your attention:

- Any waterfowl (ducks, geese etc.); raptorial birds - (eagles, hawks, falcons, kestrels, owls etc.)
- Birds of any species **if there is a clear history of central nervous system signs** (loss of fear, tremors, convulsions, paralysis, wing droop, immobile limb) in live birds, **or if there appears to be an outbreak of disease** (several birds of any species reported affected/dead in a local area [~2 km radius] within a period of 2-3 days). If more than one bird is found dead, submit up to 6 carcasses.
- Squirrels or other small mammals, especially if they have nervous signs (loss of fear, convulsions, circling, etc.).

**Use the CCWHC Incident Report Form to accompany the carcass to the CCWHC.** These cases will be diverted from the WNV surveillance stream for a full diagnostic work-up, which includes testing for Avian Influenza Virus and, in most cases, WNV. WNV infections have been detected in avian species other than those used in surveillance, as well as in grey squirrels, as a result of such submissions, but many other infectious, parasitic or toxic agents can be implicated in these cases as well.

**If it is not feasible to collect and submit such animals,** have the person reporting call the **CCWHC Call Centre (1-866-673 4781 toll-free, or 519 824 4120 Ext 54662),** or inform us by email or phone of the event, and contact information, so that we may follow up.

#### **CARCASSES TO BE SUBMITTED**

**Birds must be intact and reasonably fresh (not obviously rotten, no maggots or scavenging)** for profitable examination. **Birds that have been found on roadsides or obviously have been traumatized are acceptable.** Crows with WNV seem more susceptible to trauma and misadventure than normal, perhaps because they are sick. Carcasses that are in the open, full sun etc., could be moved to the shade by the person finding the bird, if they are willing (see instructions for handling, below).

A complete examination for cause of death is not normally carried out on WNV surveillance submissions. As well, in the event of a WNV outbreak, effort will be focused on determining the

geographic distribution of infection. Hence, WNV status may not be determined on every carcass, depending on the quality or species of the submission, workload and recent WNV activity in the Health Unit. As WNV activity clearly becomes established in a Health Unit, or more widely, dead bird surveillance will be discontinued in parts of a Health Unit, or in individual or contiguous Health Units or larger regions of the province, depending on the extent of WNV activity that has been recognized. This decision will come from the CCWHC Ontario Communications Coordinator, by email or phone, and will be preceded by consultation with Health Unit WNV contact persons regarding reasonable and clear-cut boundaries to areas from which birds should not be submitted, if the entire Health Unit is not involved. This is to save the cost of collection, submission and processing of birds from known endemic areas, so that we can focus our resources on determining the extent of the outbreak beyond its known distribution.

**If there is any uncertainty regarding whether or not a submission should be made, telephone the CCWHC Communications Coordinator for advice (1-866-673 4781 toll-free, or 519 824 4120 Ext. 54662).**

#### **HANDLING BIRDS:**

Although direct transmission of WNV from birds to people has not been proven to occur other than through accidental needle sticks, lacerations etc., during laboratory handling, West Nile virus is present at high titre in excretions and secretions from affected birds, and contact transmission and transmission by ingestion is known to occur in birds. Members of the public are to be discouraged from handling dead birds. If they must do so for submission or disposal, they should follow these guidelines, which also should be followed by all others handling birds, including Health Unit or Animal Control personnel picking up birds for surveillance. These guidelines are effectively universal precautions for handling any dead wildlife, if Highly Pathogenic Avian Influenza is not known to be circulating.

**The Public Health Agency of Canada Occupational Health Advisory on West Nile Virus** is found at: [http://www.phac-aspc.gc.ca/wnv-vwn/work\\_wnv\\_e.html](http://www.phac-aspc.gc.ca/wnv-vwn/work_wnv_e.html)

Live, sick birds should be referred to a local animal control agency, humane society, rehabilitator or collaborating veterinarian for evaluation and, if appropriate, euthanasia. If they meet the species and other criteria, such birds, and those recently-dead of natural causes are ideal submissions.

Birds or carcasses should be handled using an implement such as a small shovel or large tongs, or by hand only if disposable plastic or rubber gloves are worn. Alternatively, carcasses may be placed in a puncture-resistant leak-proof plastic bag of appropriate size by everything the bag over the hand, then grasping the carcass through the bag, and wrapping the bag around the bird without touching it. Heavy-duty plastic bags of adequate size should be used to contain the bird, sealed securely by a twist-tie, knotted string, or by knotting the bag tightly on itself. It then should be placed inside a second leak-proof plastic bag, which is similarly sealed. Double-bagging prevents cross-contamination between carcasses and fluid leaks in shipping, and is required to conform with shipping regulations. Carcasses should be chilled, but not frozen, unless it will be impossible to get them to the lab within 24-36 hours (distance, weekend intervening), in which case they should be frozen. If in doubt about freezing specimens, consult the CCWHC Communications Coordinator for advice.

Carcasses not submitted should be double-bagged and placed in garbage destined for a landfill, or buried, unbagged, several feet deep where they will not be disturbed. Do not dispose of in a

manner such that they could be handled again by someone. **People handling birds should wash hands thoroughly with soap and water afterward.**

#### **SUPPLIES REQUIRED FOR SUBMISSION OF A BIRD**

- Canadian Cooperative Wildlife Health Centre Ontario/Nunavut Region Incident Report Forms were sent to Health Units in April; download form from [http://wildlife1.usask.ca/en/local\\_submission\\_forms.php](http://wildlife1.usask.ca/en/local_submission_forms.php), or contact the CCWHC Communications Coordinator and request additional forms to be sent by fax or email attachment.
- Zip-Loc or other clear plastic bags of a size appropriate to enclose Incident Report Forms.
- Heavy duty plastic bags big enough to enclose a blue jay, crow or raven, and strong enough to resist puncture by bills, beaks and claws; secure ties for same.
- Waterproof labels/tags, or small waterproof plastic bags (Zip-loc or Whirl-pac) in which to enclose labels/tags; waterproof marking instrument.
- Frozen cold packs (**not wet ice**).
- Newspaper and a larger leak-proof plastic bag (such as a garbage bag) in which to wrap specimens.
- Insulated shipping containers: hard-sided plastic picnic cooler with return address clearly marked. Do not use styrofoam, cardboard or other non-durable shipping containers. Containers will be returned quickly.
- Heavy packing/shipping/duct tape.

#### **SUBMISSION OF SPECIMENS:**

If more than one specimen is being submitted, they should be double bagged separately. Bagged carcasses should be identified clearly, using a waterproof writing instrument, on a waterproof label or tag affixed to the carcass, or on paper sealed inside a leak-proof plastic bag, and enclosed inside the bag containing the carcass. **Each Health Unit must develop a coding system for identifying birds submitted from their region, and put the reference number on the carcass tag and on the WNV Surveillance Form in the space provided.** This number will be carried over with other information on the bird to our database, and will assist you in identifying results reported.

**A separate CCWHC Incident Report Form should be filled out legibly for each carcass to accompany the shipment.** The form, or forms, if more than one carcass is being submitted, should be enclosed in a Zip-Loc bag (it is permissible to fold the form) and placed in a sealed 8.5 x 11" envelope securely taped on the outside to the side or top of the shipping container. **Do not submit forms to CCWHC just to report sightings of dead birds.**

The Incident Report Form should include the following information; spaces to fill in, or responses to circle, prompt a response to each item on the form:

- Name of the person completing the submission form, full mailing address, telephone number, Fax number, email address
- Address to send report, if different from above
- Date bird reported to Health Unit
- Internal reference number used by the Health Unit
- Name of the person reporting dead bird(s), full mailing address, telephone number, with permission to collect this information under the Privacy Act indicated by a signature in the space provided.
- Location bird found, as distinct from the name and address of the person reporting, does not fall under the Privacy Act (most specific street or rural municipal address [Twp., Concession,

Lot #], including municipality, province or territory and postal code). In rural areas, due to implementation of an automated mapping database, 911 addresses are of little use, and Twp/concession/lot are of limited value, though each is better than no address. **If possible, for all locations, in addition to other address descriptors, include GIS coordinates** (latitude, longitude **as decimal WGS84 data to 4 decimal places or more, not minutes and seconds**). Otherwise, describe a rural address in relation to a clear locality (e.g. 6 km NW of Aberfoyle). A specific location, if possible, is very important, to facilitate mapping of each submission for epidemiologic purposes.

- Species: circle species name (crow, blue jay, raven), or 'unknown', or enter written name of 'other' species. Species of birds submitted will be confirmed by CCWHC, but try to be as accurate as possible.
- Date carcass picked up
- Date submitted

Double-bagged carcasses **must be wrapped in several layers of newspaper**, which insulates them and absorbs fluid. A freezer pack (not wet ice) should be wrapped in the newspaper with the chilled carcass(es), but is unnecessary with frozen carcasses. The carcass(es) in newspaper then should be placed in an outer plastic bag, such as a heavy-duty garbage bag, which is sealed securely. The wrapped, bagged carcass then should be placed in a hard-sided plastic insulated picnic cooler (which will be disinfected, rinsed out and sent back with a new waybill enclosed, if it has a return address). **All shipping containers must be securely packed, sufficiently sturdy, and taped shut, to prevent leaks, breakage or opening in handling. Leakage or breakage of a single package in transit could place the entire shipping system, and therefore the surveillance program, in jeopardy.**

Packages should be shipped to the address **on the pre-addressed and coded waybills provided by CCWHC**. Supplies of waybills will be sent in late April or early May, and a new waybill will be enclosed in shipping containers returned to you. The waybills provided will have been completed fully, with the exception of the information regarding the sender, and the weight. **Please fill in the weight of the parcel on all waybills.** The weight must be marked on the waybill for us to get the concessional rate on shipping charges. Parcels should be under 10 pounds gross weight, if possible. **There is no need to fill in the value of the shipment;** if you do, use 'Nil', or a value under \$100. **Do not check any options regarding delivery times in the Service Box;** these options can cost us hundreds of dollars per shipment. The contents of the parcel **have been described correctly on the preprinted waybills** sent to you. **Do not use any other terms, and do NOT check the Dangerous Goods square.** The packaging and labelling described meets the criteria for ground transport by courier of specimens to diagnostic laboratories.

Ship by Purolator Courier to the address pre-printed on the waybill. If you need additional waybills, call 1-866-673 4781 toll-free, or 519 824 4120 Ext. 54662, or email at [ccwhc@ovc.uoquelfh.ca](mailto:ccwhc@ovc.uoquelfh.ca).

Ship on Mondays to Thursdays inclusive, ground delivery. **Do not ship specimens on Friday.** Freeze specimens that cannot be shipped to arrive overnight Monday-Friday, and ship on the next appropriate day, bearing in mind any long weekends. **Phone, FAX or Email the CCWHC lab with the waybill # of each shipment,** the day that it is shipped [see phone #, email address above]. This helps us track any shipments that go astray.

Be sure to enclose all Incident Report Forms in a clearly marked envelope taped securely to the outside of the shipping container. **Do not enclose Incident Report Forms in bags with carcasses.**

## Appendix IV Mandatory Health Programs and Services Guidelines

*Excerpt*

<http://www.health.gov.on.ca/english/providers/pub/pubhealth/manprog/mhp.pdf> (Page 36)

### **INFECTIOUS DISEASES**

Infectious diseases remain an important cause of both morbidity and death in the community. Infectious diseases represent constant new challenges to public health's role as new organisms emerge as causes of disease. Others, not previously a public health problem, develop increased virulence or antibiotic resistance and become a new burden for public health infectious disease control programs. Surveillance, case-finding, contact tracing, immunization, infection control and risk assessment all work together to assure effective control of infectious diseases by public health. Public health professionals must remain vigilant to ensure that systems are in place that are capable of controlling all infectious diseases.

The programs defined are both general and specific in nature. The Control of Infectious Diseases outlines the general requirements for all Reportable and Communicable Diseases, as well as the emergency response structures which should be in place to deal with outbreaks. Specific programs are directed at controlling the potential for infectious disease in food and water. In addition, programs are directed at specific disease control requirements for sexually transmitted diseases including AIDS, tuberculosis, rabies and vaccine preventable diseases for which there are Ministry of Health immunization programs. Infection Control defines requirements for assuring that effective infection control techniques are in place in institutions, day care centres and personal service settings.

#### **Goal**

Infectious diseases will be reduced or eliminated.

#### **Control of Infectious Diseases**

#### **Goal**

To reduce the incidence of infectious diseases of public health importance.

#### **Objective**

To reduce morbidity and mortality associated with infectious diseases.

## Requirements and Standards

1. The board of health shall provide:
  - a) an on-call system that ensures 24-hour availability of appropriately trained and qualified board of health staff to respond;
  - b) assessment of a reported incident and a first response within 24 hours;
  - c) written outbreak response plans which include coordination with the public health laboratory;
  - d) identification and appropriate response to outbreaks; and
  - e) an infectious disease policy and procedure manual with current relevant information on all reportable diseases under the Health Protection and Promotion Act.
  
2. With respect to cases of Reportable Diseases and amendments, as outlined in Ontario Regulation 559/91 and Ontario Regulation 569, the board of health shall:
  - a) receive and investigate reports, in accordance with the Health Protection and Promotion Act;
  - b) apply provincial case definitions to reported cases as defined in the Reportable Diseases Information System manual;
  - c) provide on-going monitoring, including computerized data collection and analysis and application of results; and
  - d) forward reports to the Ministry of Health, including weekly transmission of data through the Reportable Diseases Information System.
  
3. With respect to cases of Communicable Diseases, as outlined in Ontario Regulation 558/91, the board of health shall:
  - a) receive and investigate reports in accordance with the provisions of the Health Protection and Promotion Act;
  - b) apply provincial case definitions to persons reported to be infected with an agent of a Communicable Disease as outlined in the Reportable Diseases Information System manual;
  - c) ensure public health management of persons found to be infected with an agent of a Communicable Disease in accordance with the infectious disease policy and procedure manual of the board of health; and
  - d) ensure the identification and appropriate management of contacts of persons found to be infected with an agent of a Communicable Disease in accordance with the infectious disease policy and procedure manual of the board of health.
  
4. The board of health shall provide information regarding infectious diseases to health care professionals, institutions and the community. This information shall be provided a minimum of once per year, through written material and/or presentations.
  
5. The board of health shall ensure implementation of the Ministry of Health *Notification of Emergency Service Workers Protocol (August 23, 1994)*.
  
6. The board of health shall provide or ensure the availability of travel health advice and immunizations for travelers.

## **Appendix V**

### **Ontario Regulation 199/03**

Health Protection and Promotion Act  
Loi sur la protection et la promotion de la santé

Amended to O.Reg. 413/06  
Control of West Nile Virus

***This Regulation is made in English only.***

#### **Determination if action required**

1. A medical officer of health shall make a determination whether action is required by a municipality to decrease the risk of West Nile Virus to persons either inside or outside the health unit served by the medical officer of health, based upon a local risk assessment in accordance with the document entitled *West Nile Virus Preparedness and Prevention Plan for Ontario*, published by and available from the Ministry of Health and Long-Term Care, dated June 26, 2006. O.Reg. 231/03, s.1; O.Reg. 322/04, s.1.

#### **Notice to municipality**

2. (1) Where the medical officer of health has determined that action is required, he or she may give notice to the municipality of the required action. O.Reg. 199/03, s.2(1).

(2) In determining required actions under subsection (1), the medical officer of health shall have regard to,

(a) the document mentioned in section 1; and

(b) the generally accepted practices in the field of public health with regard to decreasing the risk of West Nile virus to persons. O. Reg. 199/03, s.2(2).

#### **Must comply**

3. A municipality shall comply with any requirements set out in the notice. O.Reg. 199/03, s.3.

#### **What may be required**

4. Action required under this Regulation may include, without being limited to,

(a) requirements respecting source reduction measures;

(b) requirements respecting surveillance;

(c) requirements respecting public awareness campaigns about personal protection;

(d) requirements respecting the control measures for larviciding and adulticiding set out in Table 1; and

(e) requirements respecting the time within which the action shall be taken. O.Reg. 199/03, s.4.

TABLE 1  
Larviciding and Adulticiding in Ontario — West Nile Virus Response

“Triggers” based on surveillance of WNV positive humans, birds, mosquito pools or mammals (horses)

Current-Year WNV findings in Health Unit or municipality	Last Year’s WNV findings in Health Unit or municipality	Preparatory Status (Larval surveys, mosquito trapping, mapping, training, etc.)	Larviciding ACTION	Adulticiding ACTION
No West Nile virus found yet	No West Nile virus found; virus found in adjacent Health Unit(s)	Not yet done	Do the preparatory work, then larvicide where indicated	Not indicated
No virus found yet	Virus found	Not yet done	Do the preparatory work, then larvicide where indicated	Not indicated
No virus found yet	Virus found	Done last year and under way this year	Larvicide where indicated	Not indicated
Virus found in non-human (dead bird, mosquito pool or mammal) — isolated or as a “hot spot”	Virus found or not found	Done or under way this year	If a “hot spot” and larvae are present, larvicide around this “hot spot” (if not too late in the season)	Adulticide a 3-km “Zone” ONLY IF there are high-risk indicators of transmission to humans*
Human case(s) — one or a few in a space-time “cluster”	Virus found or not found	Done or under way this year	Larvicide around the case or cluster if larvae are present (and if not too late in season)	Adulticide a 3-km radius Zone around the case or cluster
Human cases continue to occur; continued high-risk indicators*	Virus found or not found	Done or under way this year	Larvicide widely where larvae are found (if not too late in season)	Adulticide 3-km Zones — may be contiguous or overlapping

**Note:** Public education efforts and non-pesticide means of mosquito source reduction should be in place, and increased as increasing evidence of virus is found (especially human cases) in the current year.

\* **High-risk indicators of transmission to humans:** increasing dead bird sightings; high mosquito infection rates; abundant bridge vector populations; increasing mammal (horse) cases; proximity of mosquito breeding sites to human populations (especially large population centres) and weather conditions that favour mosquito breeding.

1. These are minimum activity standards. Medical Officers of Health may increase the Zone size to be treated or take additional mosquito control actions, if justified by scientific data or recommendations.
2. Medical Officer of Health will maintain a means to record, investigate, and report 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 or she knows about to the Ministry of the Environment and/or other relevant local or provincial authorities.

O.Reg. 199/03

Note: This Regulation will be updated to reference the 2007 version of the *West Nile Virus Preparedness and Prevention Plan for Ontario*.

**Appendix VI (a)**  
**Summary Report: WNV Mosquito Control Malathion-Related Illness**

Year: \_\_\_\_\_

Number of malathion applications: \_\_\_\_\_

Estimated total number of residents in areas sprayed: \_\_\_\_\_

**NUMBER OF PERSONS WITH WNV MOSQUITO CONTROL MALATHION-RELATED ILLNESS BY SEVERITY, SEX, AGE AND EXPOSURE TYPE**

CHARACTERISTIC	CASE DEFINITION*			
	Definite	Probable	Possible	Total
<b>SEVERITY<sup>^</sup></b>				0
Death				0
High				0
Medium				0
Low				0
Sub-Total	0	0	0	0
<b>SEX:</b>				0
Male				0
Female				0
Sub-Total	0	0	0	0
<b>AGE GROUP (YEARS)</b>				0
0-5				0
6-18				0
19-60				0
>60				0
Unknown				0
Sub-Total	0	0	0	0
<b>EXPOSURE TYPE</b>				0
Occupational				0
Non-occupational				0
Sub-Total	0	0	0	0

*\*Defined by using the U.S. National case definition for acute pesticide-related illness and injury cases reportable to the National Public Health Surveillance System*

*<sup>^</sup>Defined by using the Severity Index for use in the U.S. State-Based Surveillance of Pesticide-Related Illness and Injury*

**COMMENTS:** (possible reasons for incidents, corrective action, etc.)

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\_\_\_\_\_  
Date

\_\_\_\_\_  
Medical Officer of Health

## Appendix VI (b) Malathion TOX Q & A Circular

Ministry of Health and Long-Term Care	Ministère de la Santé et des Soins de longue durée	 Ontario
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**Infectious Diseases Branch**  
8th Floor, 5700 Yonge Street  
Toronto, ON M2M 4K5

**Direction de la lutte contre les maladies infectieuses**  
5700, rue Yonge, 8e étage  
Toronto, ON M2M 4K5

### TOX Q & A Circular

#### MALATHION

This document provides information to public health practitioners on the potential adverse health effects of malathion, treatment, case definitions, severity index, and exposure standards; resource references are also included. Malathion may be used in mosquito control programs to prevent the spread of West Nile Virus. It is not expected to pose an unacceptable health risk to bystanders when applied according to label directions by trained licensed applicators.

#### What is malathion?

- Malathion (CAS number: 121-75-5) is broad-spectrum organophosphate insecticide registered in Canada for use in agriculture, home and garden, and for adult mosquito control programs. It has been used widely on a variety of agricultural crops since the 1950's in Canada and the US.
- It is a clear amber-colour liquid at room temperature with strong odour and low volatility, miscible in most organic solvents, but only slightly miscible in water. It is corrosive to some metals and may damage plastic, rubber and painted surfaces.

#### How does malathion exert its action?

- Malathion acts by inhibiting cholinesterase, the enzyme responsible for the destruction of the neurotransmitter acetylcholine. Inhibition of cholinesterase can cause accumulation of acetylcholine leading to disruption of normal physiological function. The dose required to kill adult mosquitoes, however, is much lower than that expected to produce adverse effects in humans.
- The cholinesterase inhibitory activity of malathion is primarily due to its metabolite malaxon.

## **How toxic is malathion?**

- Malathion is readily absorbed into the body by ingestion, inhalation and through the skin.
- Malathion exhibits low acute toxicity via the oral, inhalation and dermal routes of exposure.
- Direct contact may cause skin and eye irritation.
- There is suggestive evidence of carcinogenicity of malathion in animal studies at high concentrations, but insufficient evidence to assess its carcinogenicity in humans.
- High doses of malathion in animal studies were found to result in developmental effect;

## **Does malathion use in mosquito control programs pose risk to public health?**

- As with other chemical exposures, the risk of occurrence of adverse effects depends on the level of exposure to malathion and the susceptibility of the individual.
- Malathion is applied in mosquito control programs by truck-mounted or aircraft-mounted Ultra Low Volume (ULV) sprayers, dispensing very fine aerosol droplets that kill adult mosquitoes on contact. Very small amounts of malathion are used per unit area treated (up to a maximum of 60.8 g/hectare by ground application), minimizing the potential for exposure and risks to people.
- Malathion has been used safely in a number of large-scale pest control programs, including in the control of mosquitoes in Canada and the US, and in the control of Mediterranean fruit fly outbreaks in Florida and California.
- Health Canada has recently completed a risk assessment of public health uses of malathion, using most current scientific information and applying stringent safety factors, including special protection for children. It concluded that large-scale applications of malathion for adult mosquito control in residential areas do not pose unacceptable risk to bystanders and applicators, when applied by ULV equipment according to label directions. The exposure for a person who is outdoors during a spray application is estimated to be over a thousand times lower than the exposures that might pose a health concern.
- The risk assessment of malathion by the US Environmental Protection Agency has also indicated that health risks to bystanders from public health mosquito control programs are low and not of concern when used appropriately.
- Cases of significant malathion exposure may occur from accidental exposure.

- The public should be notified where and when pesticide application will take place (Regulation 914 under the Ontario Pesticide Act), so they can take measures to minimize exposure. Recommended precautions to minimize exposure include:
  - staying indoors during and immediately after spraying
  - Closing all windows and doors. Turning off air conditioning units and closing vents to circulate indoor air before spraying begins
  - Covering swimming pool surfaces
  - Covering outdoor furniture and play equipment or rinsing them off with water after spraying is finished.
  - Washing home-grown fruits and vegetables with water before cooking or eating them.
  - If eyes or skin come in contact with malathion spray, rinse immediately with water.
  - Wash clothes that come in direct contact with spray separately.

### What are the signs and symptoms of malathion overexposure?

- Exposure to high doses of malathion, such as in the case of an accidental exposure, can cause short-term adverse health effects.
- As with all organophosphates, malathion poisoning is caused by the inhibition of cholinesterase. This results in elevated levels of acetylcholine and cholinergic over stimulation peripherally at neuroeffector junctions (muscarinic effects), at skeletal myoneural junctions and autonomic ganglia (nicotinic effects), and in the central nervous system.
- Depending on the level of exposure and susceptibility of the individual, a range of signs and symptoms of malathion overexposure may be experienced including:
  - **Exocrine glands:** Salivation, lacrimation, perspiration
  - **Eyes:** Miosis (pinpoint pupils), blurred vision
  - **Respiratory:** Rhinorrhea, coughing, wheezing, bronchial secretion, chest tightness, bronchoconstriction, respiratory depression. Respiratory failure is the most common cause of death in severe cases of malathion poisoning
  - **Cardiovascular:** Changes in heart rate and blood pressure. Bradycardia and hypotension are induced by muscarinic stimulation, but may be obscured by transient tachycardia and hypertension due to nicotinic effects
  - **Gastrointestinal:** Nausea, vomiting, diarrhea, abdominal cramps
  - **Bladder:** Increased urination
  - **Skeletal Muscles:** Muscle twitching, cramps, and weakness
  - **Central Nervous System (CNS):** Headache, dizziness, drowsiness, fatigue, irritability, anxiety, confusion, tremor, convulsions, and coma. CNS effects are often the earliest manifestations of poisoning in adults and constitute the major signs and symptoms in children.

- Malathion poisoning is not known to cause delayed or long-term health effects.
- An “Intermediate Syndrome” has been reported with other organophosphates. It consists of respiratory and skeletal muscle weakness beginning 1 to 4 days after initial recovery from the acute cholinergic poisoning and may last up to 15 days.
- Rarely, the occurrence of “Organophosphate-Induced Delayed Neuropathy” (OPIDN), a distal sensory-motor polyneuropathy that may begin 6 to 21 days after exposure, has been described with other organophosphates

### How is overexposure to malathion treated?

- As with other organophosphates, the treatment acute poisoning consists of supportive measures and repeated administration of antidotes.
- If breathing is depressed or stopped, artificial respiration should be applied. Contaminated clothing and shoes should be removed and isolated. Where direct contact with the substance occurred, skin and/or eyes should be flushed immediately with water.
- Two drugs that are used to treat organophosphate toxicity are:
  - **Atropine** is the classical antidote, a cholinergic receptor antagonist which is extremely effective in blocking the effects of excess acetylcholine at peripheral muscarinic sites.
  - **Pralidoxime (2-PAM)**, a cholinesterase re-activator which is used in conjunction with atropine to relief both nicotinic and muscarinic effects. It is administered in severe poisoning cases only, and as early in poisoning as possible to be efficacious.
- Early administration of diazepam, in addition to atropine and pralidoxime, may help prevent the onset of seizures and potential brain and cardiac morphologic damage.

### Are there laboratory tests to evaluate malathion exposure?

- Blood is drawn to determine the levels of plasma cholinesterase and red blood cells (RBC) acetylcholinesterase levels. Depressions of plasma cholinesterase and/or RBC acetylcholinesterase are generally available biochemical indicators of organophosphate exposure, but are not specific to malathion. If the measured levels are lower than the lower limits of the normal activities of these enzymes, this usually indicates excessive absorption of cholinesterase-inhibiting chemicals. The absence of individual’s baseline enzyme levels and other factors, including liver damage, may affect the interpretation of the results.

- Measurement of the alkyl phosphate metabolites of malathion in urine is a better indicator of exposure, but it is not normally used due to lack of qualified laboratories that can perform this analysis.

### **How to investigate an incident of malathion exposure?**

- The "Control of West Nile Virus" regulation (199/03) under the Ontario Health Protection and Promotion Act requires the local Medical Officer of Health to "maintain a means to record, investigate, and report any confirmed or likely adverse or unintended human health effects attributed to mosquito control actions".
- Data collection on the exposure, health effects and relationship between exposure and effect is required. This includes date and location of exposure, route of exposure, date of the illness event, signs and symptoms, and laboratory test results.
- To determine causality between exposure and health effects, the criteria for exposure, health effects, and causality between exposure and effect that are used by the US national public health pesticide surveillance system to define cases of pesticide-related illness can be applied. Based on that, the following are three reportable case classifications for malathion:
  - 1) Definite case**
    - a) Exposure criteria: Laboratory/clinical/environmental corroborate exposure
    - b) Health effects criteria: two or more new post-exposure abnormal signs and/or laboratory findings reported by a licensed health care professional.
    - c) Causality criteria: there is evidence supporting causal relationship between exposure and health effect (health effects consistent with malathion and temporal relationship between exposure and health are plausible).
  - 2) Probable case**
    - a) Criteria for exposure and causality are the same as for definite case (above), and two or more new post-exposure abnormal symptoms were reported; or
    - b) Criteria for health effects and causality are same as for definite case (above), but evidence of exposure is based solely upon written or verbal report.
  - 3) Possible case**
    - a) Exposure criteria: evidence of exposure is based solely upon written or verbal report
    - b) Health effects criteria: two or more new post-exposure abnormal symptoms reported
    - c) Causality criteria: Same as for definite case

- The severity index of the US "State-Based Surveillance of Acute Pesticide Illness and Injury" can then be used in conjunction with the case definitions for malathion related illness. The four severity categories are:
  - - **S-1 Death**
    - **S-2 High severity**
      - life threatening and typically requires treatment and hospitalization
      - signs and symptoms include coma, cardiac arrest, renal failure, and respiratory depression.
      - individual sustains substantial loss of time from work or other activities (>5days)
      - individual may sustain permanent functional impairment
    - **S-3 Moderate severity**
      - severe illness often involving systemic manifestations, and treatment provided
      - no residual impairment is present
    - **S-4 Low severity**
      - often manifested by skin, eye or upper respiratory irritation. It may also include fever, headache, dizziness or fatigue.
      - typically resolved without treatment
      - minimal lost time (<3days) from work or normal activities

**What are the maximum allowable concentrations of malathion in air and drinking water in Ontario?**

- 24hr time-weighted average ambient air standard: 120ug/m<sup>3</sup> (Regulation 337 under the Environmental Protection Act).
- 8hr time-weighted average occupational exposure limit in air: 1 mg/m<sup>3</sup> inhalable vapour and aerosol
- (Regulation 833 amended to 70/5 respecting Control of Biological and Chemical Agents under the Occupational Health and Safety Act)
  - Maximum concentration in drinking water: 0.19 mg/liter (Regulation 169/03 under the Safe Drinking water Act)

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## Appendix VI (c)

### WNV Malathion Application: Human Exposure and Adverse Effects Incident Report

PATIENT INFORMATION				INCIDENT REPORT COMPLETED BY			
GENDER: <input type="checkbox"/> Male <input type="checkbox"/> Female <input type="checkbox"/> Unknown				LAST NAME: _____			
Date of Birth: ____/____/____ Month Day Year				FIRST NAME: _____			
AGE: ____ <input type="checkbox"/> Child <input type="checkbox"/> Adult <input type="checkbox"/> Unknown				DATE: ____/____/____ Month Day Year			
LAST NAME: _____				TIME: ____:____ <input type="checkbox"/> AM <input type="checkbox"/> PM			
FIRST NAME: _____				SITE: _____			
PHONE: (____) _____				PHONE: (____) _____			
ADDRESS: _____				ADDRESS: _____			
CITY: _____ POSTAL CODE: _____				CITY: _____ POSTAL CODE: _____			
EXPOSURE							
SITE:	<input type="checkbox"/> Home	<input type="checkbox"/> Other residence	<input type="checkbox"/> Workplace	<input type="checkbox"/> School	<input type="checkbox"/> Public Area	<input type="checkbox"/> Unknown	<input type="checkbox"/> Other _____
ROUTE:	<input type="checkbox"/> Ingestion	<input type="checkbox"/> Inhalation	<input type="checkbox"/> Eyes	<input type="checkbox"/> Skin	<input type="checkbox"/> Unknown	<input type="checkbox"/> Other _____	
TYPE:	<input type="checkbox"/> Drift	<input type="checkbox"/> Spray	<input type="checkbox"/> Indoor Air	<input type="checkbox"/> Surface	<input type="checkbox"/> Unknown	<input type="checkbox"/> Other _____	
DATE:	____/____/____ Month Day Year		TIME: ____:____ <input type="checkbox"/> AM			<input type="checkbox"/> PM	
ADDRESS OF EXPOSURE: _____							
SIGNS AND SYMPTOMS							
Date of onset of symptoms: ____/____/____ Month Day Year				Time: ____:____ <input type="checkbox"/> AM <input type="checkbox"/> PM			
General	Cardiovascular	Central Nervous System	Eyes	Dermal			
<input type="checkbox"/> Drowsiness <input type="checkbox"/> Fever <input type="checkbox"/> Other _____ <hr/> <b style="background-color: #e0e0e0;">Respiratory</b> <input type="checkbox"/> Cough <input type="checkbox"/> Rhinorrhea <input type="checkbox"/> Bronchial secretion <input type="checkbox"/> Bronchoconstriction <input type="checkbox"/> Wheezing <input type="checkbox"/> Respiratory depression <input type="checkbox"/> Other _____	<u>Heart rate</u> <input type="checkbox"/> Increased <input type="checkbox"/> Decreased  <u>Blood pressure</u> <input type="checkbox"/> Increased <input type="checkbox"/> Decreased <input type="checkbox"/> Other _____ <hr/> <b style="background-color: #e0e0e0;">Gastrointestinal</b> <input type="checkbox"/> Nausea <input type="checkbox"/> Vomiting <input type="checkbox"/> Diarrhea <input type="checkbox"/> Abdominal cramps <input type="checkbox"/> Other _____	<input type="checkbox"/> Headache <input type="checkbox"/> Lethargy <input type="checkbox"/> Confusion <input type="checkbox"/> Poor concentration <input type="checkbox"/> Tremor <input type="checkbox"/> Convulsions <input type="checkbox"/> Other _____ <hr/> <b style="background-color: #e0e0e0;">Skeletal Muscles</b> <input type="checkbox"/> Muscle twitching <input type="checkbox"/> Muscle cramps <input type="checkbox"/> Muscle weakness <input type="checkbox"/> Other _____	<input type="checkbox"/> Miosis (pinpoint pupils) <input type="checkbox"/> Blurred vision <input type="checkbox"/> Other _____ <hr/> <b style="background-color: #e0e0e0;">Exocrine Glands</b> <input type="checkbox"/> Salivation <input type="checkbox"/> Lacrimation (tearing) <input type="checkbox"/> Perspiration <input type="checkbox"/> Other _____ <hr/> <b style="background-color: #e0e0e0;">Bladder</b> <input type="checkbox"/> Increased urination <input type="checkbox"/> Other _____	<input type="checkbox"/> Burning sensation <input type="checkbox"/> Hives / welts <input type="checkbox"/> Irritation / pain <input type="checkbox"/> Itching <input type="checkbox"/> Rash <input type="checkbox"/> Redness <input type="checkbox"/> Swelling <input type="checkbox"/> Other _____			



## **Appendix VII**

### **Factors for Consideration for Adult Mosquito Control through Ultra-Low Volume (ULV) Application\*\***

1. Vectors of WNV, and their relative abundance
2. Mosquito Infection Rates (IRs)
3. Other available surveillance indicators
4. Meteorological data, both the current and the projected weather frame
5. Historical entomological data and its analysis
6. Historical epidemiological data and its analysis
7. Vector Index
8. Anticipated effectiveness of adulticiding
9. Multiple mosquito positive pools in a single trap
10. Mosquito pools going positive week after week in a particular site

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\*\* Developed in consultation with Dr. Robbin Lindsay,  
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