

WEST NILE VIRUS PREPAREDNESS AND PREVENTION PLAN

June 23, 2005

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 – 2005, a technical reference document for Ontario's 36 Health Units to assist with the implementation of Ontario Regulation 199/03 (Control of West Nile Virus), made under the *Health Protection and Promotion Act*. It is referred to in the document as the 'Plan'. The material in the 'Plan' incorporates the cumulative experience of public health with vector borne diseases and their control across North America, with particular emphasis on our ongoing communication with the Public Health Units of Ontario.

Under the Control of West Nile Virus Regulation (see Appendix VI), 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 germane information elements. 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 control measures) and their effective application. Further, the Regulation requires the local municipality involved to undertake those measures necessary for vector 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 2005 document, the next in the annual series, was prepared by the Public Health Division, Infectious Diseases Branch of the Ontario Ministry of Health and Long-Term Care (MOHLTC) with important 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 and Food (OMAF);
 - 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
- Public Health Agency of Canada (PHAC -formerly Health Canada)
 - National Microbiology Laboratory (NML), (formerly Health Canada, National Microbiology Laboratory (NML)
 - Centre for Infectious Disease Prevention and Control
- Canadian Cooperative Wildlife Health Centre (CCWHC)
- University of Guelph
- Brock University

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

The Ministry of Health and Long-Term Care would also like to thank the Public Health Units of Ontario for their work over the past years, and their input into the 2005 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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Executive Summary

Public Health Preparedness and Prevention Plan – An Overview

This West Nile virus (WNV) planning resource document for 2005 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 2005. 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 Aug 11/04). The Guidelines for Surveillance, Prevention and Control (3rd Revision – 2003) published by the Centers for Disease Control and Prevention (CDC), Atlanta, was also consulted for relevant information toward Ontario's Plan.

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

Health Units are also responsible for the collection and submission 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 newly initiated Integrated Public Health Information System (iPHIS) reporting tool as it comes on line through Ontario's 36 Health Units starting in Spring on a staggered schedule, with the later-starting Health Units continuing to report their WNV cases through the existing Reportable Disease Information System (RDIS) until all are using iPHIS.

Ministry of Health and Long-Term Care

The MOHLTC role is to support the Health Units in their work through cost-sharing of all WNV-related work. 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 direct funding of mosquito testing services to the number allotted for 2005, based upon the submissions in 2004, or as negotiated with the respective MOH.

Further, the MOHLTC will provide an ongoing public communication and information program to minimize WNV contact 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 latest data on WNV 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 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, and support 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 updated liaison with the Ontario Medical Association and the Ontario Hospital Association to ensure access to current WNV information for health practitioners throughout the province.

The MOHLTC is also 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 protective measures remains the primary focus of 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 personal protection through the use of mosquito repellents and protective clothing to reduce exposure to biting mosquitoes and eliminating vector (mosquito) breeding sites around the home and cottage.

Host (Bird) Surveillance

The Canadian Cooperative Wildlife Health Centre (CCWHC) will begin receiving sample birds from southern Ontario in early May, expanding into northern Ontario later in the month. Submitted birds (Crows, Blue Jays and Ravens) will be screened with the VecTest™ technique. Positive results will be confirmed by polymerase chain reaction (PCR) testing. For 2005, avian testing results will be available through a direct MOHLTC link to the Public Health Agency of Canada (PHAC) website at: <http://www.phac-aspc.gc.ca/wnv-vwn/index.html>

Both Health Canada (HC) and the Public Health Agency of Canada support the 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

WNV illness is a reportable disease under Ontario Regulation 559/91, made under the *Health Protection and Promotion Act*, effective May 1, 2003. The case definition was developed in 2004 by the National Steering Committee, Human sub-group on West Nile Virus and has been updated for 2005.

Provisions to protect Canada's blood supply are in place through prompt notification to the Canadian Blood Services (CBS) of any positive human results with blood/organ donation histories. Furthermore, CBS will be contacting Health Units and the MOHLTC about positive findings they identify amongst asymptomatic donors. CBS 'pool' test throughout the year, but will be single unit testing in areas where surveillance indicates WNV activity.

Vector (Mosquito) Surveillance

Ontario's program for mosquito-based surveillance is focused toward the prevention and the control of WNV and to some limited extent, of Eastern Equine Encephalitis (EEE). Mosquito-based surveillance remains the mainstay in the prevention and control of WNV.

The surveillance consists of adult mosquito trapping from Spring to Fall for the identification of a sub-set of the trapped mosquitoes (depending upon their number in the sample being examined) up to species level, establishing their numbers by species, and where required by the MOH, determine the WNV status of selected mosquito pools, most frequently through a Real Time Reverse Transcriptase Polymerase Chain Reaction test (RT-PCR).

Following active mosquito trapping research from 2001 through 2004 across the Province, it has now been established that approximately 20 species/groups of species have been tested positive for WNV. These species are the focus of the 2005 viral testing.

The purpose of mosquito-based surveillance is to help determine the immediacy of the risk from contracting WNV in the Health Unit. This is another very 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.

Secondary Mosquito Surveillance

Ontario has also initiated a secondary adult mosquito-based surveillance program focused upon *Culiseta melanura*, *Coquillettidia perturbans* and other species which carry the virus of Eastern Equine Encephalitis (EEE). While only one equine case of EEE was found in 2004 with no human cases, it is an important mosquito-borne disease. The MOHLTC is monitoring for the presence of these mosquito vectors to determine the potential for human infection in the areas where it has manifested in horses.

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 viral surveillance and control strategies.

Selection of Mosquito Testing Service Providers

For 2005, 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 2005. All Health Units will receive funding support at 100% to the allotted number of mosquito trap submissions with selected services rendered and approved on the part of the MOHLTC. See attached listing of mosquito species to be tested (Appendix III (a) & (b)).

Under Section 271 (1) of the Municipal Act, 2001, Health Units are required to adopt certain policies with respect to the provision of goods and services. Such policies are 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.

Geographic Information System – Program Component Development

In 2005, the Infectious Diseases Branch has commenced the development of GIS to be used in part for recording and management of disease surveillance information.

Vector (Mosquito) Consultancy for the Health Units

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 four (4) regional practical seminars held in early May in Sudbury, London, Brockville and Newmarket. The MOHLTC will again provide the mosquito traps to the Health Units as appropriate.

Additionally, the MOHLTC will provide additional epidemiological and entomological expertise through MOHLTC staff resources directly to the Health Units as required by the local Medical Officers of Health from time to time. This will permit the calculation of mosquito infection rates (MIR) with upper and lower confidence limits, vector abundance and relative population densities.

Further, the MOHLTC is working to determine the vector population densities for the years from 2001 through 2004 for each Health Unit and making other information available to Medical Officers of Health on request.

Determination of the Funded Allotment of Mosquito Trap Submissions

The allotment of mosquito traps was determined by the use pattern undertaken by each Health Unit to the close of the 2004 mosquito season, and reflective of the respective needs of each Medical Officer of Health to meet his/her obligations under the Control of West Nile Virus Regulation. If additional mosquito testing is indicated in a Health Unit above that which is allotted as in Appendix IV, the Medical Officer of Health is invited to discuss the need with the MOHLTC. Mosquito submissions will be supported through 100% MOHLTC funding for the approved allotment of submissions from June 13 through September 30, 2005. See Appendix IV for specific Health Unit allotments.

Equine (Horse) Surveillance

Equine WNV cases will be reported to the MOHLTC by the Ministry of Agriculture and Food. 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 the Ontario Ministry of Agriculture and Food and placed on their website for public reference. OMAF will also notify Public Health Units of positive cases in their respective jurisdictions.

The MOHLTC website will be linked to the OMAF website for easy, accurate and timely equine WNV surveillance information at:

<http://www.gov.on.ca/OMAFRA/english/livestock/horses/westnile.htm>

Larval and Adult 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 Medical Officers of Health with a table outlining the action response levels where 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 mosquito 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 MIRs (if available), the seasonal dynamic and the local weather and geographic factors. The Infectious Diseases Branch staff now has two years of processed historical entomological data available for review with Medical Officers of Health toward decision-making on mosquito control measures.

As indicated above, adult mosquito control often referred to as “spraying” or “fogging”, 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 and 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, including larvicide and adulticide, 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 levels, one being the community level and the other being municipal.

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 larval 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 pest control service to adulticide with malathion within 48 hours notice to any Health Unit in Ontario. This service is requested by the Medical Officer of Health, and is cost shared when called upon.

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, 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.

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.

INTRODUCTION

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 (closely related to WNV), Japanese encephalitis virus, the Kunjin and Murray Valley encephalitis viruses, and other flaviviruses.

The arthropods, or vectors which carry and transmit WNV, are mosquitoes - species such as *Culex* but also other genera and species of mosquito – and (in the “Old World”) ticks: “soft ticks” (argasids) and “hard ticks” (ixodids). The West Nile virus 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 disease.

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 increasing evidence is suggesting that these may include *Culex pipiens/restuans*. 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, and lemurs.

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, an epidemic which caused 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.

In 2001, WNV was confirmed for the first time in Ontario. 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, using some diagnostic experience gained through 2003. Following this re-

examination, the total number of 2002 cases, probable and confirmed, has been reduced to 393.

There were 89 cases of WNV illness reported in 2003, and 14 reported in 2004, including one travel case outside of Canada.

Public Health Roles in Ontario

Health Units

Health Unit responsibilities with regard to infectious diseases are set out in the Mandatory Health and Services Guidelines (excerpt in Appendix VII) and 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 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.

Health Units are also responsible for the collection and submission of avian and mosquito specimens for laboratory analysis, and those measures required to record the incidence of sample collection and disease reporting to permit mapping of the disease in Ontario.

In addition, Health Units investigate reported WNV-positive human cases and appropriately record their locations for analysis, communicate relevant blood-donor or organ-donor information to the Canadian Blood Services, and communicate the results of their investigations of WNV cases through the Reportable Disease Information System (RDIS) or the new Integrated Public Health Information System (iPHIS) reporting tool as it comes available.

For those disease cases which may be travel related Health Units also coordinate an exchange of information with those jurisdictions in which their patient may have traveled to determine the likely location of exposure to WNV.

Ministry of Health and Long-Term Care

The MOHLTC role is to support the HUs in their work through cost-sharing of all WNV-related work. The MOHLTC also provides logistical support through the direct funding of bird surveillance shipping costs, direct funding of all mosquito testing services to the number negotiated with the MOsH along with the provision of all mosquito traps.

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

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 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, and support 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 updated liaison with the Ontario Medical Association and the Ontario Hospital Association to ensure access to current WNV information for health practitioners throughout the province.

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

Public Education, Risk Communication and Community Outreach

Objective

To increase public awareness of WNV as a mosquito-borne disease; the surveillance activities and control techniques are underway, with emphasis on the personal protective measures individuals need to consider reducing their risk of exposure to the virus.

Background

MOHLTC: "Fight the Bite" Public Education Campaign (Phase II)

A comprehensive, multi-media public education campaign is the core component of the ministry's communication strategy for the 2005 season.

The campaign goal is to ensure everyone in Ontario continues to have the information they need to protect themselves and their families from WNV. The public education campaign is designed to raise awareness and to ensure the public receives accurate, timely, and useful advice and information about West Nile virus.

The predominant public message emphasizes the prevention measures necessary to reduce the risk of acquiring the virus and subsequent illness. The May to September campaign will include dissemination of print materials such as posters, tear sheets, as

well as an advertising campaign using television, print and radio. Ethnic communities will also be targeted through advertising and a fact sheet in 21 languages. This effort will support the 36 local public health units in their fight against WNV and will use partnerships with other government ministries and major retailers, where possible, to get the message out.

Advertising and collateral materials will drive the public to the ministry's INFOline (1-877-234-4343) and website for more information.

The public may also be referred to the Pest Management Regulatory Agency, Health Canada, fact sheet entitled, "DEET can be used safely on children and adults" available on the PMRA web site at:

<http://www.hc-sc.gc.ca/pmra-arla/english/mosquito/mosquito-e.html>

Health Care Provider Outreach

Health care providers, especially those in acute care hospitals, must be informed about the human surveillance plan and be reminded to report cases of encephalitis or meningitis that meet the suspect case definition for WNV and which are, by regulation, reportable diseases in Ontario. 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 will again liaise with the Ontario Medical Association and the Ontario Hospital Association in this outreach.

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 centres need information on the use of DEET-containing repellent 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-breeding sites have been identified close to residential sites. Source reduction at the local/regional level may involve the municipal departments of Public Works or Parks and Recreation, local conservation authorities, and the property owners themselves.

Furthering the public education message can also be accomplished with the use of 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 education work.

Planned Activities

- General public education “Fight the Bite” messages reinforced regarding 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 time spent outdoors 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 eavestroughs and drains: - Clear obstructions from eavestroughs 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 breeding habitats, a preventive strategy known as “source reduction”. The major vectors of WNV in Ontario are the *Culex* species which tend to breed in natural or artificial “containers” of standing water. Other vectors of WNV, such as certain species of *Aedes* and *Ochlerotatus*, prefer to breed 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) breeding habitats. In addition to existing paper maps, mapping tools such as a geographic information system (GIS) or global positioning system (GPS) unit will be helpful. If a municipal department (e.g., Public Works, Parks and Recreation, Roads or Transit) does not have GIS or GPS units, one of these tools may be available through local conservation authorities, or the district offices of the Ministry of Natural Resources (MNR) or 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 breeding sites for female

mosquitoes in which to lay their eggs. Tires that have a function, such as anchors for tarps, 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 breeding vectors. Cut grass and remove vegetation around the banks of sewage lagoons.

Every effort and initiative must be considered to eliminate vector (mosquito) breeding sites on public and private property. Initiate closer “personal service” contacts with community institutions (places of worship; homeowner associations; business groups; community service clubs) or initiate door-to-door promotion of mosquito breeding 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 centres, etc.

Promote mosquito breeding source site reduction campaigns by inserting fact sheets in taxation or local flyers.

Offer presentations/displays at retail garden outlets, seniors’ centres, 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 breeding site (source) elimination or reduction, primarily in urban areas.

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 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 relatively common where they are endemic, making 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 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.

It is important to note that the absence of positive bird findings over the season does not imply that WNV is no longer in the local bird population. It may simply mean that the Health Unit is not submitting birds to be tested because it has been established that WNV is present in the area. 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.

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.

Other Animals and WNV infection

The degree to which other animals and birds contribute to the host–vector cycle has yet to be determined. Some animals are considered to be “dead end” hosts (e.g., horses and humans) since there is no further transmission to another species. These “dead end” hosts are unlikely to transmit the virus via the mosquito vector because the amount of virus circulating in the host’s blood is insufficient.

Planned Activities

The surveillance of selected dead birds for WNV remains a public health activity for 2005. Dead blue jays will be added to the submitted species for 2005, with crows and ravens continuing to be submitted. Blue jays have been added as a surveillance species by the CCWHC to ensure that adequate numbers of susceptible birds will be available for sampling in the event Health Units experience a decline in local crow populations. Ravens will continue to be accepted from the northern Health Units as they were in the past.

Commencing in May, 2005, 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 in 2002, 2003 and 2004 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).

The dead Crows and Blue Jays will be submitted for testing to the CCWHC in Guelph. The birds will be VecTested™ and the first birds found positive will be confirmed by polymerase chain reaction (PCR) testing to eliminate the risk of a false positive test influencing the public health response to WNV infection. Positive WNV results will be reported to the submitting Health Unit and to the Public Health Branch simultaneously with the results posted to the Health Canada website.

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 <http://www.phac-aspc.gc.ca/wnv-vwn/index.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 86% of the Health Units in their risk assessment considerations. Some of the 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 at all (one Health Unit reported being notified repeatedly of a rock which had been mistaken and reported for a bird by automobile drivers numerous 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 with the Ministry of Natural Resources in the area as well as with the CCWHC. Both agencies may have useful information to consider in assessing the relative risk implied by the observation. For further information see Appendix V under 'Other Species of Birds and Mammals'.

For 2005, the MOHLTC will not maintain a dead bird 'sightings' file on its website.

VecTest™

In 2003, a new WNV screening tool, known as the VecTest™, was utilized by CCWHC and was proven effective through 2004. This test involves taking a swab of the oropharyngeal 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 Health 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 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 2005. 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.

Dead Bird Submission Schedule for 2005	
Commencing May 9	Health units in Ontario south of North Bay & Sudbury Health Units
Commencing May 24	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.

Both Health Canada (HC) and the Public Health Agency of Canada (PHAC) support the 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 rapidly detect WNV illness in humans.

Background

Human Clinical Manifestations

The clinical manifestations of West Nile virus illness and long-term conditions resulting from WNV disease continue to be identified as scientific literature becomes available. The incubation period ranges from 2 to 15 days.

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 based on the use of the following information:

WNV Illness:- 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” (See Appendix I). Data from the U.S.A. indicate that most WNV infections are often clinically not apparent or mild. 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. Current data indicate that the most significant risk factor for developing severe neurological disease remains advanced age.

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: The clinical picture of WNV Neurological Syndrome may include the symptoms of WNV Non-Neurological Syndrome. In addition to WNV Non-Neurological Syndrome symptoms, manifestations may include change in mental state, severe muscle weakness, flaccid paralysis, myelitis, seizures, polyradiculitis, cranial nerve abnormalities including optic neuritis, ataxia and extrapyramidal signs. Symptoms of encephalitis are more commonly reported than meningitis. Conditions identified in 2002 include poliomyelitis-like syndrome, acute flaccid-paralysis, and rhabdomyolysis.

Modes of Transmission

The mosquito vector is the mode of transmission that accounts for the majority of human infections. In 2002, several new modes of transmission were identified. These modes included human bloodborne 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.

Bloodborne Transmission

Transmission of WNV via human blood and organs has been documented in several cases in the U.S.A. The initial reports are available in Morbidity and Mortality Weekly Report (MMWR) October 4, 2002/51(39); 879. Transmission via human blood transfusion was considered the most likely source of one individual in Ontario in 2002. Bloodborne transmission is also being investigated as the source of infection in several other cases.

Vertical Transmission

Maternal Milk

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 Workers

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.

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 repellants.

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

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 following website:

<http://www.cdc.gov/ncidod/dvbid/westnile/q&a.htm>.

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 Division (IDB) through providing a completed “WNV” questionnaire using the Reportable Diseases Information System (RDIS).

With the implementation of the Integrated Public Health Information System (iPHIS) across all Health Units during 2005, the full WNV questionnaire will revert to become a reference document for iPHIS entry information.

Note:

Health Unit staff are asked to contact acute care hospitals in the Health Unit on a weekly basis from the beginning of July through the end of November 2005 to ensure active surveillance for WNV cases is being implemented.

SURVEILLANCE FOR WEST NILE VIRUS ILLNESS (Case Definitions)

Ontario’s WNV case definition (see Appendix I for details) is based on the Public Health Agency of Canada’s case definition, and will be 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

This table provides a summary of the various categories of WNV cases identified by the interpretation of the primary laboratory-screening test, IgM ELISA. For additional information on other laboratory tests and specific clinical criteria, please refer to the Case Definition document included with this package.

Note:

For the 2005 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 Public Health Laboratory will maintain an ongoing and random regime 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.

Illness Type	Category	Clinical Criteria	Laboratory Criteria
West Nile virus Neurological Syndrome	Suspect	Yes	Pending Or Serum IgM ELISA Indeterminate
	Probable	Yes	Serum IgM ELISA Positive
	Confirmed	Yes	Serum IgM ELISA Positive + 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 + Confirmation by PRNT
West Nile virus Asymptomatic Infection	Probable	No	Serum IgM ELISA Positive
	Confirmed	No	Serum IgM ELISA Positive + Confirmation by PRNT

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

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

Vector (mosquito) surveillance was identified as the most important data in the risk assessments undertaken by the Health Units in 2003 and 2004 under the Control of West Nile Virus Regulation. In response, the allotted number of mosquito sample submissions for the province has been increased to more than 9000.

The surveillance consists of adult mosquito trapping from Spring to Fall for the identification of these trapped mosquitoes up to species level, establishing their numbers by species, and carrying out a Real Time Reverse Transcriptase Polymerase Chain Reaction (RT-PCR) test to determine the WNV status of three mosquito pools in the submitted sample. Some services screen the vector samples with other techniques before submitting their WNV-positive results to RT-PCR testing for confirmation.

Following active mosquito trapping data analysis from 2001 through 2004 across the Province, it has now been established that approximately 20 species/groups of species have tested positive for WNV. These species were the focus of the 2004 viral testing. With the advantage of 2004 to analyze, it appears that *Culex pipiens*, *Culex restuans*, *Culex pipiens/restuans* are the driving forces behind the disease in Ontario. It is, therefore, for this reason that these species will get the priority attention in vector testing, including WNV viral status determination.

The purpose of mosquito (vector) based surveillance is to help determine the immediacy of the risk from contracting WNV in the Health Unit. This is another very 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.

The mosquito traps utilized in Ontario are mainly CDC 'light' traps which use both CO₂ and light to attract mosquitoes. In addition to the CDC traps, nine Health Units have piloted the use of 'Gravid' traps, trapping tools expressly designed to attract gravid mosquitoes that have bitten at least once (perhaps more often) in their lifetime and could have picked up the infection. Gravid traps are frequently used to monitor

ovipositing segment of *Culex pipiens*, *Culex restuans*, *Culex pipiens/restuans* and *Ochlerotatus japonicus* populations. As noted above, together with *Oc. japonicus* these species have been incriminated as important vectors of WNV either in Ontario or elsewhere.

WNV positive mosquito pools tend to be area specific, and can be an excellent indicator of the threat from WNV in a specific locality such as a village or other defined community. Traps may be set out by the Health Unit on a permanent basis throughout the community, or be moved about to determine mosquito status in new locations of interest. A mix of fixed and flexible trap locations will be recommended to achieve representative coverage of the jurisdiction.

Positive mosquito results are also reflective of local bird infection even though the number of indicator species may not have been found, or when submitted, proved negative for WNV. This is because of the broad range the birds may fly, and the fact that immunity may be anticipated as the disease becomes highly endemic in the avian population resulting in fewer deaths of birds.

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

Ontario has also initiated a secondary adult vector surveillance program focused upon *Culiseta melanura*, *Coquillettidia perturbans* and other species which carry the virus of EEE. While EEE was found in horses only in one Health Unit in 2004 and in nine Health Units in 2003, and more notably Ontario has never had a human case, it is an important mosquito-borne disease. The MOHLTC is monitoring for the presence of the vectors to determine the potential for human infection in the areas where it has manifested in horses.

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

The traps specific to the vectors of EEE virus and the trapping methodologies have been introduced to the Health Units through mosquito surveillance workshops held in Spring 2005.

Selection of Mosquito Testing Service Providers

For 2005, 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 will be required to work to standard reporting formats created by the MOHLTC for 2005 and adhere to a quality control (QC) regime. All Health Units will receive funding support at 100% to the

allotted number of mosquito trap submission approved on the part of the MOHLTC (see Appendix IV). For a listing of the vector species to be tested and the QC expectations, see Appendix III.

Under Section 271 (1) of the Municipal Act, 2001, Health Units are required to adopt certain policies with respect to the provision of goods and services. Such policies are 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.

WNV Vector (Mosquito) Consultancy for the Health Units

The MOHLTC will be providing, on request, field consultation to all Health Units to guide, review and evaluate local vector mosquito surveillance programs as well as providing training for Health Unit staff. Four vector surveillance and control workshops have been arranged in May to be delivered in London, Sudbury, Newmarket and Brockville. This MOHLTC Health Unit staff education workshop will share the latest practical field information on the placing and maintaining of mosquito traps, the different type of traps and their target species, along with the rationale for the time frame during the day for their respective distribution in the field. These four sessions will also have a simultaneous data entry workshop component to introduce WNV data entry into the new iPHIS system for disease reporting in Ontario for HU staff responsible to enter disease data.

On an ongoing basis, the MOHLTC will provide additional epidemiological and entomological expertise through MOHLTC directly to the Health Units as required by the local Medical Officer of Health from time to time. This will include the calculation of mosquito infection rates (MIR) with upper and lower confidence limits.

In addition, the MOHLTC is working to determine the vector population densities for the years 2001 through 2004 for each Health Unit and making the information available to the respective Medical Officers of Health on request.

Determination of the Funded Allotment of Mosquito Trap Submissions

The allotment of mosquito traps was determined by the use pattern undertaken by each HU to the close of the 2004 mosquito season, and is regarded as reflective of the respective needs of each Medical Officer of Health to meet his/her obligations under the Control of West Nile Virus Regulation.

If additional funded mosquito testing is indicated in a Health Unit above that which is allotted as in Appendix IV, the Medical Officer of Health is invited to discuss the need with the MOHLTC.

Mosquito submissions will be supported through 100% MOHLTC funding for the approved allotment of submissions from June 13 through September 30, 2005. See Appendix IV for specific Health Unit allotments.

Mosquito Traps to include 'Gravid' Trap Option

As noted, the MOHLTC will provide the mosquito traps to the Health Units as appropriate. As part of their allotment of mosquito traps for 2004, a number of Health Units had utilized some 'Gravid' mosquito traps in addition to the CDC light traps used since 2002 as a pilot project. The pilot 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.

Vectors (Mosquitoes)

Vectors are those mosquitoes that maintain the WNV host–vector cycle of viral transmission. In Ontario, mosquitoes have been categorized into two types, “bridge” vectors and “enzootic” vectors. “Bridge” vectors consist of mosquito species that feed from birds and humans, and thus pose greater risk to humans. “Enzootic” vectors primarily feed from birds, and thus maintain the host–vector cycle of viral transmission. Evidence is growing that there may be considerable overlap between the two categories - that “enzootic” vectors may occasionally feed from mammals, including humans, and it must be noted that recent data analysis suggests that strict segmentation of mosquito species by preference of host may not be accurate for a number of reasons. MOHLTC data analysis suggests that *Culex pipiens*, *Culex restuans*, *Culex pipiens/restuans* were consistently present in areas where human cases were identified, and this data was shared at the National Steering Committee’s annual meeting in December 2004. This finding was further borne out by a recent publication with a similar finding by A. Marm Kilpatrick et al noting that *Culex spp* was possibly the most responsible WNV vector of all the mosquitoes tested in the northeastern United States.

Further work is required to establish the degree to which such strict categories as ‘enzootic’ and ‘bridge’ are useful in addressing WNV prevention.

Extrinsic Incubation Period (EIP)

A WNV-infected mosquito does not indicate that the mosquito in question is necessarily a confirmed 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

become a true 'vector' – i. e. capable of infecting a feeding host individual. 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 mosquito cannot transmit the virus. For most mosquitoes which carry the WNV this extrinsic incubation period is estimated from 10 to 12 days in ideal conditions – longer when conditions are less than ideal.

Planned Activities

- Vector (mosquito) surveillance in Ontario in 2005 will enumerate and identify the presence of WNV-competent species of mosquitoes and determine the WNV viral status of three of the mosquito pools, generally the most numerous three vectors. For 2005, however, because of the evidence that *Culex pipiens*, *Culex restuans*, *Culex pipiens/restuans* are the common vectors in our area of North America, the MOHLTC is asking that regardless of their numbers and the above policy, HUs include any *Culex pipiens*, *Culex restuans*, *Culex pipiens/restuans* among the three pools to be tested for WNV. This information to the various 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;
 - assist in providing information about the risk to the public of acquiring WNV illness based on the presence of WNV within specific local areas.
 - Assist 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.
- In addition, the MOHLTC is working to determine the vector population densities from 2001 through 2004 for each Health Unit and will be making the information available to the respective Medical Officers of Health on request.
- Health Units are requested to share their mosquito vector surveillance data as soon as possible with the MOHLTC for monitoring and for posting on the MOHLTC website.
- Mosquito surveillance in 2005 is established through analyzing data from 2001 through 2004. The allotment of mosquito traps and laboratory submissions was determined by a survey of requirements undertaken at the close of the 2003 mosquito season, and blended with the actual field usage by the HUs through 2004. This has been deemed to be reflective of the anticipated needs of each Medical Officer of Health to meet his/her obligations under O. Reg. 199/03. Each Medical Officer of Health may vary his/her allotment with respect to seasonal timing for mosquitoes as required to assess the local risk from WNV.
- For planning purposes, the 100% funded allotment has been established as in Appendix IV.

- For 2005, 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 service providers will be required to work to standard reporting formats created by the MOHLTC for 2005. All Health Units will receive funding support at 100% 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 III (a) & (b)].
- Both CO₂-baited CDC light traps and “Gravid” traps may be used in 2005. This is the recommendation of the mosquito sub-group of the National Steering Committee for West Nile Virus chaired by Health Canada. Health Units will be provided with the appropriate number of CDC light traps and Gravid traps prior to the start of the season.
- 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 (MIR’s) and maintain a data sheet and records for Health Units’ reference upon request.
- The MOHLTC website will record the WNV positive mosquito pools as reported and confirmed by the mosquito testing service providers.

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 and another 9 in 2004.

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. It is recognized that the cost of testing is usually borne by the horse owner and that together with the increasing vaccination of horses against WNV infection may limit the usefulness of equine surveillance.

Equine Vaccine

An equine vaccination product is available from veterinary practitioners in North America. The Ontario Ministry of Agriculture and Food 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 Activity

Equine WNV cases will be reported to the MOHLTC by the Ministry of Agriculture and Food. 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 the Ontario Ministry of Agriculture and Food and placed on their website for public reference. OMAF will also notify Public Health Units of positive cases in their respective jurisdictions.

For 2005, the Ministry of Agriculture and Food website will be linked from the MOHLTC website to permit easy, accurate and timely access to the data without duplication. The OMAF website linkage will be to:

<http://www.gov.on.ca/OMAFRA/english/livestock/horses/westnile.htm>

Geographic Information System – Program Component Development

In 2005, the Infectious Diseases Branch has commenced the development of GIS to be used in part for recording and management of disease surveillance information.

WEST NILE VIRUS PREVENTION AND CONTROL

LARVAL AND ADULT VECTOR (MOSQUITO) MANAGEMENT

Objective

To suppress the adult mosquito populations through the use of Integrated Pest Management techniques.

Background

All mosquitoes begin their life in water. *Culex pipiens*, *Culex restuans*, *Culex pipiens/restuans*, the primary vectors of WNV and some of the most common mosquitoes found in urban areas, breed quickly and use standing water containing decaying organic materials to lay their eggs. Prime breeding 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 breeding 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 breeding sites on personal property. Local Health Units should emphasize elimination of breeding sites within their local communities at a resident level, including commercial sites, which are often significant sources of potential breeding.
- 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 Means

- “Larviciding”, when used to control WNV or other vector borne disease, means a vector control involving the use of approved pesticides to control the larvae of vectors. 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 breeding. Larvicides can be biological or chemical products.

- “Adulticiding”, when used to control WNV or other vector borne disease, means a vector control involving the use of approved adulticides to 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 application units (ULV). 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.
- 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 through <http://www.pmra-arla.gc.ca/english/aboutpmra/about-e.html>.

Decision-Making and Consultation

The decision to employ larval vector (mosquito) control, including larviciding or adult (mosquito) vector control including adulticiding in Ontario is established through the application of the provisions of Regulation 199/03 (See Appendix VI). 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). Certainly all of these factors, plus taking into account all other control measures available (e. g. mosquito breeding 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 Infectious Diseases Branch of the Public Health Division is available to the 36 Health Units to consult concerning any of these decisions.

Railroad Lands Contact Information

Canadian National Railways
David Sutherland
905-669-3367
david.sutherland@cn.ca

Canadian Pacific Railways
Community Connect Line: 1-800-766-7912
community_connect@cpr.ca

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 active mosquito control. That assessment must be based on the most current and accurate data available, such data includes, but is not limited to the following:

- evidence of West Nile virus 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 local vector distribution, vector density and species identification and mosquito infection rates of known or potential vector (mosquito) populations;
- the nature and location of the vector (mosquito) breeding 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;
- other local surveillance findings (e.g., the trends in the numbers of dead bird sightings or of virus-infected birds or mammals);
- 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 West Nile virus 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 <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

Larvicides

While there are several biological and chemical larvicides presently registered for use in Canada, the Ministry of the Environment is only authorizing under approved permit the use of *Bti* (*Bacillus thuringiensis israelensis*) and *Bacillus sphaericus* (*B. sphaericus*) 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, and methoprene and *B. sphaericus* in catch basins and sewage and sludge lagoons for larval mosquito control to reduce the risk of West Nile virus.

Bti and *B. sphaericus* are bacterial spores that upon ingestion by the mosquito larva 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 or other non-target species, or to human health. PMRA have approved *Bti* and *B. sphaericus* for full registration.

Bti and *B. sphaericus* must be applied when mosquito larvae are present in various mosquito breeding sites indicated on the product labels.

Methoprene is a synthetic insect growth regulator that mimics the juvenile growth hormone in insect larvae that allows the larvae to develop into a pupae then an adult. Methoprene does not kill the larvae but arrests the development of larvae so that adults do not emerge to carry the disease. Methoprene is applied to catch basins and sewage lagoons 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-

[ara/english/index-e.htm](http://www.ene.gov.on.ca/ara/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 posted on the MOE web site at: <http://www.ene.gov.on.ca> are linked to the West Nile virus icon.

Larviciding 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.

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 is intended to slowly release the larvicide in a predetermined rate.

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 very large mosquito breeding habitats would likely have heavy vegetation or wooded areas and the liquid would not penetrate such cover 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 breeding.

Sonic Wave Treatment

One municipal experiment with sonic waves to destroy larval development demonstrated that the larvae in a catch basin were 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 proved an effective means to prevent mosquito entry into catch basins, particularly when installed early in the season to prevent the laying of eggs. Further, even when eggs hatched and developed into adults, the adults could not get out of the catch basin area because of the screening.

However, the installation of the screen however, proved a major consideration. If the screen was applied to the top of the catch basin it was 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 was not practical on street catch basins because they did not stand up to the wear from continual traffic travel over them.

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. It also required that a regular maintenance regime be established to keep the screen clear or water pools, small water bodies 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 is collected.

Vacuumping of Catch Basins

Vacuumping of the water from a catch basin again proved to be effective in that it removed the standing water together with any larvae. However, the water soon re-accumulated and permitted the reintroduction of mosquito larvae into the catch basin.

Drilling of Drainage Holes into the base of the Catch Basin

Another experiment was to drill holes in the bottom of the catch basin to allow any accumulated water to seep away, intended to prevent the egg laying and larval development.

The trials did not prove successful. The holes became plugged in a short time from street dust and debris and soon retained water in the bottom which would have required vacuuming. Further, the drilling work required specialized staff and equipment along with the lifting of the grate and providing of the protection for the workers on any traffic area. This was very resource consuming.

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.

Adulticiding as Part of Adult Mosquito Control

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 the table provided in the Control of West Nile Virus Regulation, and where to do it will be identified in the risk assessment as those local conditions which present the most significant and immediate risk to public health. Adulticiding must be included as part of any assessment grid in order to represent the complete spectrum of control measures. However, adulticiding is frequently considered as a "last resort", therefore the greater emphasis focuses on larval control programs, including larviciding, as the means of proactive prevention and the foundation for mosquito vector reduction and control.

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.

The "General Decision-Making Factors re Larviciding and Adulticiding" above should be considered.

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

The Pest Management Regulatory Agency has recently reviewed the currently registered malathion ULV adulticide for label improvements and has also 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.ene.gov.on.ca>.

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 compare the numbers of larvae per dip or per square metre of the body of water. Following larviciding with *Bti* or *B. sphaericus* the relative number of larvae/pupae collected before and after larviciding can be compared for effectiveness of the operation. 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*. With methoprene, one measure of its effectiveness is to calculate percent emergence inhibition through counting dead pupae, dead adults and rearing of live pupae to develop into live adults.

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, or the 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.

Reasons for the “failure” of these control measures are varied, and may be related to incomplete consideration of the “General Decision-Making Factors” described above, or to having inadequate or outdated data with which to consider these factors. It is acknowledged that the impacts of larviciding or adulticiding may be extremely dependent on the many variables outlined affecting local conditions, i.e., weather conditions, and situations i.e. mosquito counts, and proximity to residential areas.

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 (high temperatures or humidity) – and the limitations of ULV application in controlling adult mosquitoes over large urban areas.

Because the issue of how well a vector management program has been implemented would vary in different jurisdictions and at different times, it is difficult to make a priori generalizations 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 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: <http://www.ene.gov.on.ca/envision/land/westnile/index.htm>

Under the Control of West Nile Virus Regulation, 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 Activity

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 VII provides information on malathion to assist the health units in the investigation and reporting of potential malathion exposure in case it would be used for 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.

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 becoming, if not already, endemic in the Province, and given the large number of mosquitoes 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 mosquito population.

It is also necessary to maintain regular contact with colleagues throughout North America to ensure that we are privy to the latest thinking on WNV control, and to maintain currency with any original research.

Planned Activity

- The MOHLTC shall weekly, and more frequently if necessary, hold open communication with all Health Units through teleconferences.
- The MOHLTC e-mails information and materials on WNV matters across the province regularly to share data and information of successes or problems.
- The MOHLTC will provide regular entomological data for Ontario to aid in local risk assessment responsibilities, and will provide Health Unit specific analysis on request of the local MOH.
- The MOHLTC is supportive of the epidemiologic analysis proposed by the CCWHC in conjunction with PHAC to evaluate the usefulness of selected indicators of WNV

infection, including the utility of dead crow-sightings indices as a predictor of WNV activity.

- The MOHLTC is actively working with Public Health Agency of Canada through WNV data sharing for epidemiological analyses directly with Health Canada.

APPENDICES

Appendix I: 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 occurring¹

OR

history of exposure to an alternative mode of transmission²

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)³ 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

2.

¹History 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.

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

³ 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 occurring¹

OR

history of exposure to an alternative mode of transmission²

AND AT LEAST TWO of the following⁵:

- fever,
- myalgia⁶,
- arthralgia,
- headache,
- fatigue,
- lymphadenopathy,
- maculopapular rash

¹History 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.

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

⁵It 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.

⁶ 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)⁷:

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

⁷This 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 preform 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 ⁸ without confirmatory neutralization serology (e.g. Plaque Reduction Neutralization Test [PRNT]) OR
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 ⁸ OR
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 OR [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.

⁸ 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 testing⁹ 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.

⁹ 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. OR
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 OR
Demonstration of flavivirus antibodies in a single serum or CSF sample using a WN virus IgM ELISA ^{8,9} , confirmed by the detection of WN virus specific antibodies using a PRNT (acute or convalescent specimen). OR
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 ^{8,9} AND the detection of WN specific antibodies using a PRNT (acute or convalescent serum sample).

⁸ 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 ⁹ 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.

⁹ 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 II (a): WNV Human Case Notification Fax to MOHLTC

WEST NILE VIRUS HUMAN CASE NOTIFICATION FAX (to Ministry of Health and Long-Term Care – Version May 6, 2005)

Prior to sending the fax, telephone the Call Centre anytime (24/7) to notify them that a fax will be sent. Fax this page to fax number below. Upon receiving the fax, the Call Centre will fax you a confirmation that your fax was received.

To: MOHLTC Call Centre **Date:** _____

Phone: 416-212-6361 **Fax:** 416-326-0694

From: _____

Phone: _____ **After-Hours:** _____

Fax: _____ **Health Unit:** _____

1. CASE INFORMATION:

First Initial: _____ **Last Initial:** _____ **Sex:** Male Female

Date of Birth ____/____/____ (yy/mm/dd) **Age** _____ years/ months/ weeks

Date of First Symptoms ____/____/____ (yy/mm/dd)

iPHIS Case ID _____

Traveled outside of Ontario in last 3 weeks? Yes No Unknown

Is it likely that the IgM titre is from an exposure in 2003/4? Yes No Unknown

2. CASE CLASSIFICATION:

(Please consult the most recent version of the Case Definition for explanation of these categories)

(Classification)	Probable Case	Confirmed Case
West Nile virus Neurological Syndrome (WNNS)	<input type="checkbox"/>	<input type="checkbox"/>
West Nile virus Non-Neurological Syndrome (WN Non-NS)	<input type="checkbox"/>	<input type="checkbox"/>
West Nile virus Asymptomatic Infection (WNAI)	<input type="checkbox"/>	<input type="checkbox"/>

Case pregnant

3. Has the patient donated/received blood, plasma, and/or tissue/organs within the last 8 weeks?

Yes No Don't know/Unsure

Has the Health Unit contacted Canadian Blood Services?

Yes No Don't know/Unsure

Appendix II (b): WNV Human Case Notification Fax to CBS

**WEST NILE VIRUS HUMAN CASE NOTIFICATION FAX
(To Canadian Blood Services - Version April 27, 2005)**

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 hr: Mary Lou Pursley: 905-645-6364	Fax: 905-540-5800
London	Jonni-Lyn Van Deursen: 519-690-3926	Fax: 519-690-3960
Toronto	Blood Product Management 24 hr: 416-313-4690	Fax: 416-974-9424
Ottawa (and North East)	Elaine Fournier: 613-560-7215	

To: _____ **Date:** _____

Phone: _____ **Fax:** _____

From: _____

Phone: _____ **After-Hours:** _____

Fax: _____ **Health Unit:** _____

PATIENT INFORMATION:

Last Name: _____ **First Name:** _____

Middle Name: _____ **Sex:** Male Female

Date of Birth ___/___/___ (dd/mmm/yyyy)

Date of First Symptoms ___/___/___ (dd/mmm/yyyy)

DONATION/RECEIPT INFORMATION:

Case is a Blood Donor Yes No Unknown

Date of Previous Blood Donation ___/___/___ (dd/mmm/yyyy)

Location of Previous Blood Donation _____

Case is a Blood Recipient Yes No Unknown

Date of Previous Blood Transfusion ___/___/___ (dd/mmm/yyyy)

Location of Previous Blood Transfusion _____

Other (please specify) _____

Appendix III (a): Mosquito Species to be Identified and Reported

Mosquito Species for Identification
<i>Aedes cinereus</i>
<i>Aedes vexans vexans</i>
<i>Aedes vexans/cantator</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>Coquillettidia perturbans (pale legs)</i>
<i>Culiseta melanura</i>
<i>Culiseta morsitans</i>
<i>Culex pipiens</i>
<i>Culex restuans</i>
<i>Culex pipiens/restuans</i>
<i>Culex quinquefasciatus</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 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 20, 2005

Appendix III (b): Mosquito Species for Viral Testing

As detailed in the letter from the Chief Medical Officer of Health, Dr. Sheela Basrur (March 4, 2005), to the Medical Officers of Health, MOHLTC funding will be provided for no more than three (3) pools per submitted sample to be tested for the West Nile virus from the list below formed by the three most numerous species in that sample. Notwithstanding the above, the MOH may choose to vary the species of the three pools to be tested for WNV as he/she may require for species of concern (e. g. *Culex pipiens*, *Culex restuans* or *Culex pipiens/restuans*).

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.

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

Revised April 20, 2005

Appendix III (c): Health Unit Codes (standardized)

Code	Health Unit
ALG	Algoma Health Unit
BRN	Brant County Health Unit
CHK	Chatham – Kent Public Health Division
DUR	Durham Region Health Department
EOH	Eastern Ontario Health Unit
ELG	Elgin - St. Thomas Health Unit
GBO	Grey-Bruce Health Unit
HDN	Haldimand – Norfolk Health Unit
HKP	Halliburton - Kawartha - Pine Ridge District Health Unit
HAL	Halton Region Health Department
HAM	Hamilton – Public Health & Community Services Department
HPE	Hastings & Prince Edward Counties Health Unit
HUR	Huron County Health Unit
KFL	Kingston, Frontenac and Lennox & Addington Health Unit
LAM	Lambton County – Community Health Services Department
LGL	Leeds, Grenville and Lanark District Health Unit
MSL	Middlesex – London Health Unit
NIA	Niagara Region Public Health Department
NPD	North Bay Parry Sound District Health Unit
NWR	Northwestern Health Unit
OTT	Ottawa – Public Health & Long Term Care Branch
OXF	Oxford County – Public Health and Emergency Services
PEE	Peel Region Health Department
PDH	Perth District Health Unit
PTC	Peterborough County – City Health Unit
PQP	Porcupine Health Unit
REN	Renfrew County and District Health Unit
SMD	Simcoe Muskoka District Health Unit
SUD	Sudbury & District Health Unit
THB	Thunder Bay District Health Unit
TSK	Timiskaming Health Unit
TOR	Toronto Public Health
WAT	Waterloo Region Public Health
WDG	Wellington - Dufferin - Guelph Health Unit
WEC	Windsor - Essex County Health Unit
YRK	York Region Health Services Department

Revised April 4, 2005

Appendix III (d): Week Codes (standardized)

Week Number	Sunday (Start of week)	Saturday (End of week)
13	March 27, 2005	April 2, 2005
14	April 3, 2005	April 9, 2005
15	April 10, 2005	April 16, 2005
16	April 17, 2005	April 23, 2005
17	April 24, 2005	April 30, 2005
18	May 1, 2005	May 7, 2005
19	May 8, 2005	May 14, 2005
20	May 15, 2005	May 21, 2005
21	May 22, 2005	May 28, 2005
22	May 29, 2005	June 4, 2005
23	June 5, 2005	June 11, 2005
24	June 12, 2005	June 18, 2005
25	June 19, 2005	June 25, 2005
26	June 26, 2005	July 2, 2005
27	July 3, 2005	July 9, 2005
28	July 10, 2005	July 16, 2005
29	July 17, 2005	July 23, 2005
30	July 24, 2005	July 30, 2005
31	July 31, 2005	August 6, 2005
32	August 7, 2005	August 13, 2005
33	August 14, 2005	August 20, 2005
34	August 21, 2005	August 27, 2005
35	August 28, 2005	September 3, 2005
36	September 4, 2005	September 10, 2005
36	September 11, 2005	September 17, 2005
38	September 18, 2005	September 24, 2005
39	September 25, 2005	October 1, 2005
40	October 2, 2005	October 8, 2005
41	October 9, 2005	October 15, 2005
42	October 16, 2005	October 22, 2005
43	October 23, 2005	October 29, 2005
44	October 30, 2005	November 5, 2005
45	November 6, 2005	November 12, 2005
46	November 13, 2005	November 19, 2005
47	November 20, 2005	November 26, 2005
48	November 27, 2005	December 3, 2005
49	December 4, 2005	December 10, 2005
50	December 11, 2005	December 17, 2005
51	December 18, 2005	December 24, 2005
52	December 25, 2005	December 31, 2005
1	January 1, 2006	January 7, 2006

Appendix IV: Mosquito Sample Allotments to Health Units

Health Unit	Traps	Weeks	Total Sub
Algoma	20	11	220
Brant	10	16	160
Chatham-Kent	10	16	160
Durham	40	16	640
Eastern Ontario	9	14	126
Elgin-St. Thomas	5	14	70
Grey Bruce	7	14	98
Haliburton-Kawartha	20	16	320
Halidmand-Norfolk	20	14	280
Halton	17	16	272
Hamilton	40	16	640
Hastings-Prince Edward	10	14	140
Huron County	10	14	140
Kingston, Frontenac	5	16	80
Lambton	15	16	240
Leeds, Grenville	10	14	140
Middlesex – London	15	16	240
Niagara	15	16	240
North Bay – Parry Sound	14	11	154
North Western	20	11	220
Ottawa	45	16	720
Oxford	10	16	160
Peel	30	16	480
Perth	10	14	140
Peterborough	5	16	80
Porcupine	20	11	220
Renfrew	10	16	160
Simcoe – Muskoka	21	16	336
Sudbury	20	11	220
Thunder Bay	21	11	231
Timiskiming	10	11	110
Toronto	45	16	720
Waterloo	10	16	160
Wellington-Dufferin	10	16	160
Windsor-Essex	10	16	160
York Region	30	16	480
	619	-	9117

Revised May 3, 2005

Appendix V: The Handling and Submission of Avian Specimens

Thanks to CCWHC – Dr. Ian Barker
ONTARIO WEST NILE VIRUS RESPONSE - 2005
CCWHC Ontario/Nunavut - March, 2005

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, 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, inform caller of means of carcass disposal (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 WNV Surveillance 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 2005 WNV Surveillance Form (to be sent to Health Units in April).

SPECIES OF PARTICULAR CONCERN:

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

Photos: http://wildlife1.usask.ca/ccwhc2003/west_nile_virus/bird_pictures.php

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 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 WNV Surveillance 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 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 Communications Coordinator (519 824 4120 Ext 54662)** for instructions on how to submit a case themselves, or inform us by email or phone of the event, 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 (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.

The Public Health Agency of Canada Occupational Health Advisory on West Nile Virus is found at: http://www.phac-aspc.gc.ca/wnv-vwn/pdf/wnv_occhealth2003_e.pdf

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 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 WNV Surveillance Forms: to be sent in April; download 2005 form from <http://wildlife1.usask.ca/ccwhc2003/>; 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 WNV Surveillance 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 WNV Surveillance Form (2005) 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 2005 WNV Surveillance 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
- Location bird found (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 a new 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 rural 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 April or early May 2005, 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 as a '**DIAGNOSTIC SPECIMEN**' 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:

**Canadian Cooperative Wildlife Health Centre,
OVC Receiving, McGilvray St.,
University of Guelph,
Guelph, ON N1G 2W1.**

[If you need additional waybills, call 519 824 4120 Ext. 54662, or email at ccwhc@ovc.uoguelph.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 WNV Surveillance Forms in a clearly marked envelope taped securely to the outside of the shipping container. **Do not enclose WNV Surveillance Forms in bags with carcasses.**

Appendix VI: Ontario Regulation 199/03

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

Amended to O.Reg. 322/04
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 May 28, 2004. 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,

Appendix VII: Mandatory Health Programs and Services Guidelines

Excerpt

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

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 569/90, 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 VIII (a), (b) and (c)

Malathion Questions and Answers

O. Regulation 199/03 under the Health Protection and Promotion Act requires the 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" for the prevention of West Nile Virus (WNV). To assist the health units in the investigation and reporting of potential malathion exposure in case it would be used for mosquito control, Appendix VIII contains the following three documents:

a) Malathion TOX Questions and Answers

- Provides information on the potential adverse health effects of malathion, case definitions, severity index, exposure standards, treatment, and resource references.

b) Malathion Incident Reporting Template

- This form can be used by the health unit and health care providers to collect data including exposure, health effects and treatment for each incident report.
- The health unit should immediately notify the MOHLTC of any definite, probable and possible cases of high and medium severity, and of any cluster of cases of low severity. The possible reasons for the occurrences and any corrective actions taken should also be reported.

c) Surveillance for Malathion-Related Illness Summary Report Template

- A summary report of all malathion-related cases to be completed in this form and signed by the Medical Officer, and submitted to the MOHLTC.

The health units should make arrangements with health care providers in their community to ensure that this reporting is as complete and timely as possible.

Appendix VIII (a): Malathion TOX Q & A Circular

Ministry
of
Health
and
Long-Term Care

Ministère
de la
Santé
et des
Soins de longue durée



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 overstimulation 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/m³ (Regulation 337 under the Environmental Protection Act).
- 8hr time-weighted average occupational exposure limit in air: 1 mg/m³ 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 VIII (b): Adverse Health Effects Reporting Form

Ministry of Health and Long-Term Care

WEST NILE VIRUS MALATHION APPLICATION: HUMAN EXPOSURE AND ADVERSE EFFECTS INCIDENT REPORT

PATIENT INFORMATION

GENDER: Male Female Unknown

Date of Birth: ____/____/____
Month Day Year

AGE: ____ Child Adult Unknown

LAST NAME: _____

FIRST NAME: _____

PHONE: (____) _____

ADDRESS: _____

CITY: _____ POSTAL CODE: _____

INCIDENT REPORT COMPLETED BY

LAST NAME: _____

FIRST NAME: _____

DATE: ____/____/____
Month Day Year

TIME: ____:____ AM PM

SITE: _____

PHONE: (____) _____

ADDRESS: _____

CITY: _____ POSTAL CODE: _____

EXPOSURE

SITE: Home Other residence Workplace School Public Area Unknown Other _____

ROUTE: Ingestion Inhalation Eyes Skin Unknown Other _____

TYPE: Drift Spray Indoor Air Surface Unknown Other _____

DATE: ____/____/____ TIME: ____:____ AM PM
Month Day Year

ADDRESS OF EXPOSURE: _____

SIGNS AND SYMPTOMS

Date of onset of symptoms: ____/____/____
Month Day Year

Time: ____:____ AM PM

<p>General</p> <p><input type="checkbox"/> Drowsiness</p> <p><input type="checkbox"/> Fever</p> <p><input type="checkbox"/> Other _____</p> <hr/> <p>Respiratory</p> <p><input type="checkbox"/> Cough</p> <p><input type="checkbox"/> Rhinorrhea</p> <p><input type="checkbox"/> Bronchial secretion</p> <p><input type="checkbox"/> Bronchoconstriction</p> <p><input type="checkbox"/> Wheezing</p> <p><input type="checkbox"/> Respiratory depression</p> <p><input type="checkbox"/> Other _____</p> <hr/>	<p>Cardiovascular</p> <p><u>Heart rate</u></p> <p><input type="checkbox"/> Increased</p> <p><input type="checkbox"/> Decreased</p> <p><u>Blood pressure</u></p> <p><input type="checkbox"/> Increased</p> <p><input type="checkbox"/> Decreased</p> <p><input type="checkbox"/> Other _____</p> <p>Gastrointestinal</p> <p><input type="checkbox"/> Nausea</p> <p><input type="checkbox"/> Vomiting</p> <p><input type="checkbox"/> Diarrhea</p> <p><input type="checkbox"/> Abdominal cramps</p> <p><input type="checkbox"/> Other _____</p> <hr/>	<p>Central Nervous System</p> <p><input type="checkbox"/> Headache</p> <p><input type="checkbox"/> Lethargy</p> <p><input type="checkbox"/> Confusion</p> <p><input type="checkbox"/> Poor concentration</p> <p><input type="checkbox"/> Tremor</p> <p><input type="checkbox"/> Convulsions</p> <p><input type="checkbox"/> Other _____</p> <p>Skeletal Muscles</p> <p><input type="checkbox"/> Muscle twitching</p> <p><input type="checkbox"/> Muscle cramps</p> <p><input type="checkbox"/> Muscle weakness</p> <p><input type="checkbox"/> Other _____</p> <hr/>	<p>Eyes</p> <p><input type="checkbox"/> Miosis (pinpoint pupils)</p> <p><input type="checkbox"/> Blurred vision</p> <p><input type="checkbox"/> Other _____</p> <p>Exocrine Glands</p> <p><input type="checkbox"/> Salivation</p> <p><input type="checkbox"/> Lacrimation (tearing)</p> <p><input type="checkbox"/> Perspiration</p> <p><input type="checkbox"/> Other _____</p> <p>Bladder</p> <p><input type="checkbox"/> Increased urination</p> <p><input type="checkbox"/> Other _____</p> <hr/>	<p>Dermal</p> <p><input type="checkbox"/> Burning sensation</p> <p><input type="checkbox"/> Hives / welts</p> <p><input type="checkbox"/> Irritation / pain</p> <p><input type="checkbox"/> Itching</p> <p><input type="checkbox"/> Rash</p> <p><input type="checkbox"/> Redness</p> <p><input type="checkbox"/> Swelling</p> <p><input type="checkbox"/> Other _____</p> <hr/>
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Appendix VIII (c): Summary Report of Malathion Related Illness

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
SEVERITY^				0
Death				0
High				0
Medium				0
Low				0
Sub-Total	0	0	0	0
SEX:				0
Male				0
Female				0
Sub-Total	0	0	0	0
AGE GROUP (YEARS)				0
0-5				0
6-18				0
19-60				0
>60				0
Unknown				0
Sub-Total	0	0	0	0
EXPOSURE TYPE				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*

^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.)

Date

Medical Officer of Health