West Nile Virus

Preparedness and Prevention Plan

for

Ontario

May 27, 2003

Ontario Ministry of Health and Long-Term Care

Preface

This following document is the most recent version, revised May 27, 2003, of the *West Nile Virus - Preparedness and Prevention Plan for Ontario – 2003,* a technical reference document for Ontario's 37 Health Units. The original document was issued with the same title in March 2003.

The May 27th edition of the province's *West Nile Virus - Preparedness and Prevention Plan for Ontario – 2003* addresses the enhanced mosquito control measures under O. Reg. 199/03 and incorporates discussions from the working group of Health Unit representatives on implementation relating to the new Regulation.

Under O. Reg. 199/03, the Medical Officer of Health is required to conduct a risk assessment of the local conditions pertaining to WNv in the Health Unit. This risk assessment will identify where the required mosquito control activities (i.e., larviciding or adulticiding) can most effectively be applied, and further, requires the local municipality to undertake the measures necessary for mosquito control. The municipality is required to carry out specific mosquito control measures when directed by the medical officer of health.

Under the Regulation, the Medical Officer of Health is required to record, investigate, and report any confirmed or likely adverse or unintended human health effects attributed to mosquito control actions, and report any non-human environmental adverse effects to the Ministry of the Environment and/or other relevant local or provincial authorities.

Acknowledgements

This document was prepared by the Public Health Branch of the Ontario Ministry of Health and Long-Term Care (MOHLTC) with important input and assistance from the following contributors during 2001, 2002 and 2003:

- Ontario MOHLTC, Laboratories Branch;
- Ontario MOHLTC, Communications and Information Branch;
- Ontario Ministry of the Environment, Standards Development Branch, Pesticides Section;
- Ontario Ministry of Agriculture, Food and Rural Affairs, Veterinary Science (now called Ontario Ministry of Agriculture and Food);
- Ontario Ministry of Natural Resources, Forest Management Branch;
- The Canadian Cooperative Wildlife Health Centre;
- Health Canada, National Microbiology Laboratory;
- Health Canada, Centre for Infectious Disease Prevention and Control;
- The University of Guelph;
- Brock University

The Public Health Branch is also appreciative of the advice from the federal-provincial National Steering Committee for West Nile Virus.

In particular, the Ministry of Health and Long-Term Care would like to thank the Health Units of Ontario for their input into the 2003 *West Nile Virus Preparedness and Prevention Plan.*

Special thanks is given to the City of Chicago and the City of New York for the excellent model plan, and for placing it in the public domain.

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Executive Summary

Public Heath Preparedness and Prevention Plan – 2003 Overview

The Ontario West Nile virus (WNv) planning resource document for 2003 builds on the experience Ontario's public health system had with West Nile virus since 2000. This document incorporates new findings over the same period, and represents the field guide to the 7-Point Action Plan announced by the Ministry of Health and Long-Term Care (MOHLTC) on March 22, 2003. The 7-Point Action Plan includes expanded laboratory services, enhanced surveillance, an extensive public education campaign, a new early warning system, a study to determine extent of community exposure to WNv and ongoing research activity.

The planning resource document is designed to provide the planning basis for a provincial approach to the preventing and controlling of West Nile virus by provincial Health Units, which provide the first line of public health protection in Ontario.

The plan is premised upon the local Health Units undertaking a risk assessment pertinent to their jurisdiction to ensure that all relevant factors are taken into consideration around decisions involving appropriate actions as required by the *Health Protection and Promotion Act* and relevant regulations, as well as the report of the National Guidelines for the Prevention of West Nile virus 2002 (Draft – January 3, 2003).

Public Education, Risk Communication and Community Outreach

Public education on personal protective measures remains the primary focus of intervention by the MOHLTC, and the provinces Health Units will again be provided with materials produced by the Ministry's Communications and Information Branch.

Public education will focus on personal protection through the use of mosquito repellents, protective clothing, and reducing exposure to biting mosquitoes. The education materials will be updated to address new information that has emerged regarding the transmission of WNv in Ontario (blood products, organ transplants, maternal vertical transfer.) This education strategy will also include a proactive outreach program that takes the message about the importance of identifying and reducing mosquito-breeding sites directly to homeowners and residents in the community.

Host (Bird) Surveillance

The Canadian Cooperative Wildlife Health Centre (CCWHC) will focus on birds from those areas where WNv appeared in humans in 2002, and then expand the program across the province on a tiered basis. The sampling began approximately one month earlier (April 15) than in previous years, and will utilize a new technique called the VecTest™. The timeliness of WNv detection will be much improved with the VecTest™. Health Canada will continue to support the testing at the CCWHC.

Human Surveillance

WNv illness is now a reportable illness under Ontario Regulation 559/91, made under the *Health Protection and Promotion Act,* which became effective on May 1, 2003. WNv also has a new case definition and provisions to protect Canada's blood supply are in place (see page 12)

Mosquito Surveillance
Mosquito enumeration and species identification will be provided by Brock University through 2003 and will be available to all Health Units. In addition, the 2003 mosquito surveillance will include viral testing of mosquito pools.

As with the bird sampling, a tiered response will be used based upon the findings of WNv human cases from last year and the mosquito results of past years. Brock University will also be providing a field consultation service to all Health Units to review local mosquito surveillance programs as well as providing training for Health Unit staff who did not receive training previously. As before, the MOHLTC will provide the light traps to the Health Units.

Larval and Adult Mosquito Control
The Ministry has provided the Health Units with a table outlining the action response levels for larviciding and adulticiding. The action levels are contained in O. Reg. 199/03 (see Appendix 7). With respect to larviciding, the Ministry has undertaken to provide at no cost to the Health Units, all larviciding materials, and to share the costs of all larviciding application work.

The Ministry of the Environment (MOE) is the regulatory provincial agency for all pesticide applications, such as larviciding or adulticiding (see definitions page 21). Public Health Branch staff are available for consultation by Medical Officers of Health on aspects of their risk assessments at the Health Unit level for decision-making around mosquito control measures.

A local risk assessment is an essential prerequisite to a decision to implement mosquito control measures. It is expected that a decision to implement mosquito control measures will be guided by this Plan and the provisions of O. Reg. 199/03. Control measures (larviciding or adulticiding) must take into consideration the current, available data, populations at risk, the burden or impact of WNv mortality and morbidity in the human population, non-human surveillance findings, vector density, distribution and infection rates (if available), seasonal factors and local weather and geographic factors.

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. Given the public concern over adulticiding, emphasis is placed on larviciding programs, with the expectation that reduction of mosquito populations at the larva stage in the life cycle will reduce the potential need for adulticiding programs later.

Surveillance of Potential Adverse Health Effects from Pesticide Exposure
By regulation under the *Health Protection and Promotion Act*, the Health Units are required to record, investigate and report any confirmed or potential adverse or unintended human health effects attributed to mosquito control actions, and will report any non-human environmental adverse effects to the Ministry of the Environment and other relevant local or provincial authorities.

Equine (Horse) Surveillance
Equine WNv cases will be reported to the MOHLTC by the Ministry of Agriculture and Food. Data are anticipated to be more complete for the WNv situation in horses because the Canadian Food Inspection Agency (CFIA) has made WNv in horses an immediately notifiable disease under its legislation.

Research and Evaluation
There are several studies underway in Ontario.

A human seroprevalence study is currently underway in Halton Region to determine the extent of community exposure to WNv. The objective of the study is to gather data on how many people were infected with WNv in 2002, but did not exhibit serious WNv illness. This study will provide a baseline for determining the percentage of Ontarians who become infected but do not manifest clinical symptoms of WNv illness.

An evaluation will be undertaken of the impact, if any, which the viral testing of mosquitoes may have had on the decisions made by the Medical Officers of Health in 2003 respecting whether to larvicide or to adulticide.

A study is being undertaken by Health Canada and the Canadian Cooperative Wildlife Health Centre to determine the efficacy of the recording of dead bird sightings for public health protection. The recording of such dead bird sightings will be regarded as a local option until the results of the study are known. The Ministry will review the data at that time.

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 – mostly bird-feeding 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". 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 1937. 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 southeastern 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, of which seven were fatal. The method of importation of WNv is unknown, but it may have arrived in an infected human or 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.

During the winter of 1999-2000, the virus survived in mosquitoes in the New York City sewer system, and in the summer of 2000, the virus continued to spread. 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 all provinces across Canada. Ontario had no cases recorded prior to 2002. In 2002, a total of 392 WNv cases in humans (307 confirmed and 85 probable) were reported.

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 to reduce their risk of exposure to the virus.

Background

Ministry of Health and Long-Term Care "Fight the Bite" public education campaign

A multi-media, comprehensive public education campaign is the core component of the ministry's communication strategy for the 2003 season.

The campaign goal is to ensure everyone in Ontario has 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 April to October campaign will include print materials such as eight million copies of a brochure distributed to every home in Ontario, posters, a retail point of purchase promotion, and television, print and radio advertising. This effort will support the 37 local public health units in their fight against WNv and will use partnerships with other government ministries and major retailers to get the message out.

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 Public Health Branch, MOHLTC will provide physicians with an education package on human surveillance, clinical information and diagnostic testing. The ministry will also provide the Ontario Hospital Association and Ontario Medical Association with copies of this Prevention and Preparedness Plan, 2003.

Public education activities within the local Health Unit

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 Medical Officer of Health regarding mosquito control activities. In particular, special-needs persons must be advised through appropriate means when adulticiding is planned and appropriately accommodated.

In terms of prevention measures, the general public education campaign message must be re-emphasized around personal protection against biting mosquitoes, including the application of approved insect repellent. Outdoor recreational and 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 mosquito-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 awareness for themselves, as well as 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

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

Local Source Reduction

Mosquito populations can be diminished 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 species of *Culex* 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 (see Appendix 3, "Mosquitoes of Southern Ontario".) Municipal, local or regional authorities can engage in the following examples of source reduction activities:

- Conduct mapping of known or possible 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 regraded in order to prevent the accumulation of long-standing 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. Old tires left outside collect water after each rainfall and create perfect breeding sites for female mosquitoes 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 old tires for recycling).
- Flush storm drains, catch basins and drainage ditches at least once per week or after each rainfall to remove stagnant water.
- Monitor sewage lagoons and retention ponds to ensure they are not breeding mosquitoes. Cut grass and remove vegetation around the banks of sewage lagoons.
- 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.
- Every effort and initiative must be considered to eliminate mosquito breeding sites on public and private property, both residential and commercial land.

Special-needs persons will be specifically addressed and given the guidance to accommodate their needs should adulticiding take place within the Health Unit boundary.

HOST (BIRD) SURVEILLANCE

Objective

To utilize the data from bird and mammal mortality as a means of early detection of West Nile virus activity as a means of predicting the potential risk of human WNv illness.

Background

In 2002, the number of animals identified that were infected by WNv, and which exhibited disease symptoms, increased considerably. A few of the animals identified with WNv included squirrels, wolves, dogs, mountain goats, muskrats, and sheep as well as a Barbary ape and various other animals at the Metro Toronto Zoo. In Ontario, other birds identified with WNv by the Canadian Cooperative Wildlife Health Centre include the Red-Tailed hawk, Great Horned owl, Coopers hawk, Sharp-shinned hawk, American robin, Great Black-backed gull, and the Canada goose.

In Ontario, corvids (i.e., crows, blue jays and ravens) are thought to be important hosts in maintaining the endemic host–vector cycle of viral transmission. 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 hosts blood is insufficient.

Planned Activities

- The surveillance of dead crows for WNv remains a public health activity for 2003.
- In 2003, dead crow surveillance activities, which began this year on April 15, will be phased in based on the schedule distributed to the Health Units by the Canadian Cooperative Wildlife Health Centre. The goal is to intensively test earlier than previous years in those Health Unit areas most affected in 2002 in order to identify WNV-infected birds as early as possible.
- Health Units will collect and submit dead crows (and those Health Units in the north may include ravens)
- The dead crows will be submitted for VecTest™ testing to the Canadian Cooperative Wildlife Health Centre in Guelph. Results will be sent to the submitting Health Unit and to the Public Health Branch, MOHLTC simultaneously with the results posted to the MOHLTC website.
- Dead crow sightings data were being received by CCWHC on their website as of May 1, 2003 as a Health Unit operational option. Those Health Units wishing to utilize this database service should contact Ron Templeman at ron.templeman@usask.ca for operational details.

"Sightings" Synopsis

At the request of many Health Units, the MOHLTC will record dead crow sightings reports on its website on a weekly basis. Participating Health Units are requested to submit their dead crow sighting data to the Public Health Branch on each Wednesday for the previous week. Health Units will need to get the message out within their community, via public service announcements, regarding the Health Unit's program for collection of bird samples and which

type of bird (only crows) the public should call in as part of the dead bird sightings reports, in order to manage the potential volume of calls.

VecTest™

For 2003, a new WNv screening tool, known as the VecTest™, is now available and will be utilized by CCWHC. This test involves taking a swab of the oro-pharangeal area (nostrils or more correctly, the nares). The tests provide confirmatory test results within 15 minutes.

Initially, the National Microbiological Laboratory in Winnipeg will confirm one VecTest™ result in a series to validate the indicated findings. All VecTest™ positive results will be reported directly by CCWHC to the Health Unit involved, to the Public Health Branch, and to Health Canada.

The VecTest™ is 85% sensitive and 95% specific. Sensitivity is the ability of the test to detect the disease when it is present. (A lack of sensitivity increases the rate of false negatives.) Specificity is the ability of a test to detect the absence of disease. (A lack of specificity increases the rate of false positives.)

Scheduling for Dead Bird Surveillance

All scheduling of dead bird testing is the responsibility of the Canadian Cooperative Wildlife Health Centre. CCWHC has advised that, should a broad infection rate among submitted birds in a given area become evident, they reserve the right to change the scheduling of bird submissions accordingly.

Dead Bird Submission Schedule for 2003	
As of April 15	• Windsor-Essex; Chatham-Kent; Lambton; Elgin-St. Thomas; Middlesex-London; Oxford; Brant; Haldimand-Norfolk; Niagara; Hamilton; Halton; Peel; Toronto; York Region; Durham
Commencing May 5	• Health Units in the remainder of southern Ontario south of Muskoka-Parry Sound and Renfrew extending from Lake Huron to Ottawa and Eastern Ontario
From May 5 onward	• all Health Units are to ship no more than four (4) dead crows per week
Beginning May 20	• remaining Health Units in the northern parts of the province may begin shipping dead crows and ravens

Shipping Protocol

Shipments should be made "PUROLATOR COLLECT", and pre-printed labels and submission forms 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 1, "*The Handling and Submission of Specimens - Ontario West Nile Response*", by Dr. Ian Barker of the Canadian Cooperative Wildlife Health Centre in Guelph.**

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 3 to 14 days.

Planned Activities
The activities for human surveillance will be implemented throughout the healthcare system and involve family physicians, community hospitals, public health laboratory service, the local Medical Officer of Health and the Public Health Branch 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 Health Canada for reporting the disease, "WNv Illness" can be considered to consist of two clinical pictures, "WNv Fever" and "WNv Neurological Manifestations". There is also a case definition for "WNv Asymptomatic Infection" (See Appendix 6). 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 mild illness (WNv Fever), 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 Fever (or "*West Nile Fever*") is the milder form of WNv Illness. Clinical symptoms include a febrile illness of sudden onset plus one or more of the following: 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 Manifestations: The clinical picture of WNv Neurological Manifestations may include the symptoms of WNv Fever. Symptoms of encephalitis are more commonly reported than meningitis. In addition to WNv fever 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. 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 mothers milk and intra-uterine transmission, and transmission via occupational hazards in the case of laboratory workers. Mention of 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 four other cases.

Vertical Transmission

Maternal Milk

Transmission of WNv from mother to infant via the mothers milk was considered the most likely source of an infants 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

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.

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 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. In addition, under Regulation 338/96, the name and other personal information of WNv illness cases must be provided to Canadian Blood Services for the purpose of protecting blood products where there are reasonable grounds to believe that the person has or may have been

a blood recipient or donor. The May 21, 2003 version of the WNv case definition is attached to the end of this document.

The following provides reporting responsibilities by selected agencies:

- Central Public Health Laboratory
  a) Reports WNv positive laboratory results to, in order of priority:
     - Physician (note – both positive and negative results are reported to physician)
     - Local Medical Officer of Health
     - Public Health Branch
  b) Reports the name and other personal information of WNv suspect cases to the Public Health Branch, for the purposes of reporting to Canadian Blood Services.

- Public Health Branch, Ministry of Health and Long-Term Care
  - As per Regulation 338/96, reports the name and other personal information of WNv suspect cases received from the Central Public Health Laboratory to Canadian Blood Services.

- Physician
  a) Reports human WNv *suspect, possible, probable*, and *confirmed* cases, as per any reportable disease, to the local Medical Officer of Health
  b) As per Regulation 338/96, reports the WNv suspect cases name, date of birth, and date of onset of symptoms to the local Medical Officer of Health, where there are reasonable grounds to believe that the person has or may have been a blood recipient or donor.

- Local Medical Officer of Health
  a) Reports the WNv suspect cases name, date of birth, and date of onset of symptoms, received from physicians, where there are reasonable grounds to believe that the person has or may have been a blood recipient or donor to Canadian Blood Services;
  b) Reports information on human WNv *possible, probable* and *confirmed* cases to, in order of priority:
     - Canadian Blood Services – "blood transmission" information included on pages one and two of the WNv questionnaire should be faxed, as per instructions on the questionnaire, to the PHB. The PHB will forward this information immediately to CBS;
     - PHB – provide a completed "WNv" questionnaire. With the full implementation of RDIS across all Health Units, the WNv questionnaire will then be discontinued.

Note:
Health Unit staff are asked to contact acute care hospitals in the Health Unit on a weekly basis to ensure active surveillance for WNv cases is being implemented.

- Canadian Blood Services
  a) In keeping with the CBS protocol for traceback for donors or recipients, a recent report from the *West Nile Virus Hospital Contingency Planning Task Force on Blood Recommendations* has made recommendations. These will ensure the continued safety of Canada's blood supply with ongoing and, if necessary, duplicated communication mechanisms in place to ensure no gaps in the transferring of important information in the event that CBS identifies a positive blood test in a blood donor or the public health services determine a potential threat to the blood supply. It is anticipated that these recommendations will be implemented. The reporting priority is:
     1. Donor
     2. Physician
     3. Local Medical Officer of Health

Surveillance for West Nile virus Illness (Case Definitions)

Ontario's WNv case definition (see Appendix 6 for details) is based on Health Canada's case definition as drafted to date, and will be proactively implemented for 2003. At the time of writing, Health Canada's case definition had not been completed. Ontario's case definition will be updated in order to be consistent with the Health Canada case definition upon completion. Both Ontario's and Health Canada's 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.

For surveillance purposes, WNv illness will consist of WNv Neurological Manifestations (WNNM), WNv Fever (WNF), and WNv Asymptomatic Infection (WNAI). WNNM and WNF will each consist of the categories "Suspect", "Possible", "Probable", and "Confirmed", and WNAI will consist of the categories "Probable" and "Confirmed", respectively, depending on laboratory diagnostic test results.

The case definitions have two criteria for each of WNNM, WNF, 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.

	Category	Clinical Criteria	Laboratory Criteria
West Nile virus Neurological Manifestations	Suspect	Yes	Pending
	Possible	Yes	Serum IgM ELISA Indeterminate
	Probable	Yes	Serum IgM ELISA Positive
	Confirmed*	Yes	Serum IgM ELISA Positive + Confirmation by PRNT
West Nile virus Fever	Suspect	Yes	Pending
	Possible	Yes	Serum IgM ELISA Indeterminate
	Probable	Yes	Serum IgM ELISA Positive
	Confirmed*	Yes	Serum IgM ELISA Positive + Confirmation by PRNT
West Nile virus Asymptomatic Infections	Probable	No	Serum IgM ELISA Positive
	Confirmed*	No	Serum IgM ELISA Positive + Confirmation by PRNT

*** Note: After five cases have been confirmed by PRNT in a Health Unit area, cases meeting the probable laboratory criteria will be classified as confirmed cases.**

MOSQUITO SURVEILLANCE

Objective

To identify the local areas where the presence of WNv poses the most direct threat to humans.

Background

Mosquitoes are the vectors that maintain the host–vector cycle of viral transmission. In Ontario, mosquitoes can be categorized into two types, "bridge" vectors and "enzootic" vectors, based on the species affinity for biting humans.

"Bridge" vectors consist of mosquito species that feed from birds and humans, and thus pose a risk to humans.

"Enzootic" vectors primarily feed from birds, and thus maintain the host–vector cycle of viral transmission. There may be considerable overlap between the two categories in that "enzootic" vectors may occasionally feed from humans.

In Ontario, a cumulative total of 598 pools consisting of two enzootic vectors and six bridge vectors were laboratory confirmed with WNv by year-end of 2002. These WNV-positive mosquitoes were identified in 19 Health Unit jurisdictions.

A recent study has established that a WNv-infected mosquito does not indicate that the mosquito is a confirmed vector, or will potentially transmit the virus. If the virus is present in the mosquitoes intestinal tract after a blood meal, the mosquito is infected but cannot transmit the virus. The virus must be in the mosquitoes salivary glands in order to infect an individual. The *extrinsic incubation period* (EIP) is the time from ingestion of virus to the time it is present in the salivary glands. If the mosquitoes life span is less than the EIP, the mosquito cannot transmit the virus.

Planned Activities

- Mosquito surveillance in Ontario in 2003 will enumerate and identify the species of mosquitoes present in the various Health Units in order to:
  - assist Health Units with vector data in their risk assessment to support the decision to larvicide or adulticide;
  - assist in providing information about the risk to the public of acquiring WNv Illness based on the presence of WNv within specific local areas.

- Health Units are requested to share their mosquito surveillance data as soon as possible with the MOHLTC for posting on the MOHLTC website.

- Mosquito surveillance in 2003 is planned to take place:
  - between May 26 and October 10, a period of 20 weeks in southern Ontario; and
  - between July 28 and October 3, a period of 10 weeks in northern Ontario.

Three-Tiered System For Mosquito Collection

The data gathered from the public health activities across the province in 2001 and 2002 have been used to design a three-tiered system based on WNv presence in 2001 and 2002 for WNv risk projection. This system will maximize the resources and facilities available at Brock University. The tier structures are:

Tier 1 and 1(a)

- 1 - High Human Population + moderate WNv bird activity in 2001 and 2002 + moderate incidence of WNv in humans (5 traps per week over 20-week period)
  - Durham; Hamilton-Wentworth; Middlesex-London; Niagara; Windsor-Essex; York Region

- 1 (a) - Very High Human Population + high WNv bird activity in 2001 and 2002 + high incidence of WNv in humans (15 traps per week over 20-week period)
  - Halton; Peel; Toronto

Tier 2

- Moderate Human Population + lower WNv bird activity in 2001 and 2002 + lower WNv incidence in humans (5 traps every other week over 20-week period)
  - Brant County; Chatham-Kent; Eastern Ontario; Elgin-St. Thomas; Grey Bruce; Haldimand-Norfolk; Haliburton-Kawartha-Pine Ridge; Hastings-Prince Edward Counties; Huron; Kingston; Lambton; Leeds-Grenville and Lanark; Muskoka-Parry Sound; Oxford; People Services Branch (Ottawa-Carleton); Perth; Peterborough County-City; Simcoe; Renfrew; Waterloo; Wellington-Dufferin-Guelph

Tier 3

- Lower Human Population + lowest WNv bird activity in 2001 and 2002 + little or no WNv incidence in humans (5 traps per week over 10-week period)
  - Algoma; North Bay; Northwestern; Porcupine; Sudbury; Thunder Bay; Timiskaming

Mosquito Traps

Only CO_2-baited Centres for Disease Control light traps will be used. "Gravid" traps will no longer be used.

Health Units were provided with the appropriate number of CDC light traps prior to May, as indicated the initial version of the Plan.

Training will also be provided for Health Unit staff who did not participate in adult mosquito surveillance in 2002.

Enumeration and Species Identification training will be provided at Brock University.

Testing of Mosquito Pools for WNv

WN viral testing for mosquito pools will be provided by Brock University in 2003.

EQUINE (HORSE) SURVEILLANCE

Objective

To monitor WNv in horses throughout the province to support data on the presence of the virus as an indicator of its epizootic transmission to mammals and of its general impact on local communities.

Background

WNv in horses often occurs concurrently, or sometimes just prior, to confirmation of human infection. 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.

Vaccine

An equine vaccination product is available from veterinary practitioners in North America. The Ontario Ministry of Agriculture and Food continues to promote the WNv vaccination of horses to large animal veterinarians in Ontario. Equine practitioners can send serum samples to the Veterinary Service Laboratory in Guelph for analysis. While there is no federal policy for action on equine WNv, the Canadian Food Inspection Agency must be notified of any case of equine WNv.

Equine cases in Ontario were first reported in 2002. A total of 101 confirmed and 6 probable cases was reported. Of the confirmed cases, 38% (38/101) were from Essex County. Of the 17 Health Units involved, 7 were in South West Ontario, 5 in Central West Ontario, 2 in Northern Ontario, 1 in Eastern Ontario and 2 in Central East Ontario.

Planned Activity

Reporting to MOHLTC

The Ministry of Agriculture and Food has agreed to provide the data they receive to the Ministry of Health and Long-Term Care, and the information will be shared with the Health Units upon receipt.

LARVAL AND ADULT MOSQUITO CONTROL

Objective

To reduce the abundance of adult mosquitoes through the use of Integrated Pest Management techniques.

Background

All mosquitoes begin their life in water. *Culex pipiens*, a primary enzootic vector of WNv and one of the most common mosquitoes found in northern urban areas, breed quickly and use standing or slow-moving water to lay their eggs in decaying, organic materials. Prime breeding sites include discarded tires, poorly maintained bird baths, clogged drain gutters, unused swimming and plastic wading pools, pots and pans with standing water, and puddles that last for a week or more.

Potential enzootic vectors (tested positive in 2002 season)		
Species	**Relative Frequency**	**Active**
Culex pipiens	common	night active
Culex restuans	common	night active

Potential bridge vectors (tested positive in 2002 season)		
Species	**Relative Frequency**	**Active**
Aedes vexans	Common	night active
*Coquilletidia perturbans**	Common	night active
Culex salinarius	Not common	night active
Ochlerotatus triseriatus	Not common	day active
Ochlerotatus trivittatus	Not common	day & night active
Anopheles punctipennis	Not common	day & night active
The following species are found in Ontario, but are relatively rare (tested positive for WNv in the USA, but not in Canada; implicated as potential bridge vectors in the USA)		
Species	**Relative Frequency**	**Active**
Anopheles quadrimaculatus	Not common	day & night active
Ochlerotatus canadensis	Not common	day active
Ochlerotatus sollicitans	Not common	day active

* *Coquilletidia perturbans* larvae are unusual among mosquito larvae in that they are found in soft mud attached to the bases of submerged aquatic plants in marshes; they obtain their oxygen from air tubes within the roots of several aquatic plants including cattails, water-lilies, reeds, sedges, water-arum, pickerelweed and arrowhead.

Planned Activities

- Eliminating breeding sites is the simplest and most effective way to reduce the number of mosquitoes. The MOHLTC-mounted public education campaign "Fight the Bite" emphasizes personal protective measures and homeowner guidelines to reduce mosquito breeding sites on personal property. Local Health Units should emphasize elimination of breeding sites within their local communities, including commercial sites, which are often significant sources of potential breeding.
- "Larviciding" is the use of approved insecticides against the larvae of mosquitoes or other insects. Larvicides are usually dispensed in the form of pellets or granules that are dropped into pools or containers of standing water where mosquitoes are breeding. Larvicides can be biological or chemical products. This year, there is a larvicidal product that homeowners can purchase from licensed retail outlets for use around their private property, and do not need an application permit from the Ministry of the Environment. Community-based applications do require a licensed permit from Ministry of the Environment and must be applied by trained and licensed staff.

- "Adulticiding" refers to the use of approved pesticides against the adult stage of insects. Adulticides are chemical products in liquid form that are aerosolized and "sprayed" into the air. ("Fogging" is a more accurate term when the adulticides are conveyed as ultra-low volume (ULV) droplets). Adulticides may be delivered by backpack sprayers, truck-mounted foggers, or by aerial means.

Decision-Making and Consultation

The decision to employ mosquito larviciding or adulticiding is established through Regulation 199/03 (See Appendix 7). The determination of where to apply the larviciding or adulticiding 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, mosquito pools and/or equines). All of these factors, plus taking into account all other control measures available are incorporated into weighing the expected benefits and risks of pesticide use. The risk assessment should also take into account all of the existing non-pesticide means of mosquito reduction and the measures available to prevent or reduce disease transmission such as personal protective measures against biting mosquitoes.

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 expert authorities.

General Decision-Making Factors re 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, e.g.,

- evidence of West Nile virus human 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 distribution, density and (if available) species identification and virus infection rates of known or potential vector mosquito populations;
- the nature and location of the mosquito breeding site(s) to be treated, including the type of container or body of water, and its proximity to human populations at risk and the ease of access to insecticide applicators;
- 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 (see Appendix 2; 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.

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 "Fight the Bite" campaign, prevention messages state that "everyone is at risk".

Registration and Regulation of Pesticide Use in Canada

Federal and provincial regulations regarding the use of larvicide or adulticide, as for other registered pesticides in Canada, must be followed. (See Appendix 2 for provincial Ministry of the Environment regulations; for the federal authority, please contact the Pest Management Regulatory Agency by phoning 1-800-267-6315 or via the Health Canada website at: www.hc-sc.gc.ca/pmra-arla/english/index-e.html.

Larvicides

There are biological and chemical larvicides presently registered for use in Canada.

The primary biological (microbial) larvicide registered in Canada is a form of bacterial spore called *Bacillus thuringiensis israelensis* ("*Bti*" for short). Following ingestion by the mosquito larva, the *Bti* spores release crystallized toxin in the larva's stomach which causes death. Safety evaluation of *Bti* application for larval control has shown little or no risk to wildlife or other non-target species, or to human health, if accidentally ingested. The *Bti* toxin is released in the alkaline environment of the insect larva's stomach, whereas human and animal stomachs have acidic environments.

Bti may be applied to irrigation ditches, flood ditches or pastures, marshes, woodland pools, standing ponds, or storm water retention ponds. Timing of *Bti* applications is important: the 2nd or 3rd instar stages of the larva are targeted. Although the 1st instar stage is susceptible, targeting the later instars ensures that all the eggs were hatched prior to application. The limited treatment window is a relative disadvantage. Because of its short residual activity, *Bti* may need to be applied frequently to have a sustained effect; this can be labour-intensive and costly.

A domestic-quantity formulation of *Bti (Aquabac)* has recently become available to homeowners through licensed retail outlets for application on private property. Homeowners do not need a permit from the Ministry of the Environment to apply this domestic *Bti* product on private property.

Methoprene is sometimes called a "biorational" compound because it is a synthesized version of naturally-occurring compounds, in this case, a "juvenile-stage" hormone found in mosquito larvae. Methoprene arrests the development of larvae so that adults do not emerge to carry the disease. Methoprene is administered when the larvae are mainly in the later instars. Methoprene comes in slow-release formulations, which can be placed in difficult-to-reach locations.

Methoprene "does not pose unreasonable risks to wildlife, people, or the environment" (see reference #1 at the end of this section). It breaks down quickly in water and soil and does not leach into groundwater. Methoprene has low toxicity to birds and fish and is non-toxic to bees. Reports of frog abnormalities have not been verified. However, methoprene is toxic to some aquatic invertebrates such as crayfish. The Pest Management Regulatory Agency (PMRA) has included special precautions on the label. Methoprene use does require a permit from Ministry of the Environment and must be applied by trained and licensed staff.

Diflubenzuron is another insect growth inhibitor that disrupts the moulting process by inhibiting the synthesis in the insects exoskeleton formation, leading to desiccation and death. It is seldom used because it will also inhibit the exoskeleton development of other insects or crustaceans.

Chlorpyrifos is effective and less expensive than *Bti* or methoprene. However, the Pest Management Regulatory Agency has recently restricted the use of chlorpyrifos to areas where children do not live or play.

Fenthion is rarely used as a larvicide because of its toxicity to birds. (It is also registered as an adulticide.)

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.

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.

Mechanical Means of Larval Control

There are also mechanical means of larval control; these are newly available and are being site-tested. Such mechanical measures 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.

Adulticiding

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 that it will be done is guided by the Table provided in O. Reg. 199/03 (see Appendix 7), 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 larviciding programs as the means of proactive prevention and the foundation in mosquito 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 (*see below*). 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".)

Seasonal timing is also important. From about mid-to-late August, larviciding will have very limited effect in preventing the transmission of mosquito-borne virus in Ontario's temperate climate because subsequently emerging adults will not be seeking blood meals but, instead, will be going into "diapause" to prepare for the oncoming cold season. At that point, adulticiding would be the only urgent mosquito control measure available if existing non-pesticide measures were not preventing further spread of West Nile virus.

The Pest Management Regulatory Agency has registered six active ingredients as adulticides for mosquito control in Canada: malathion and dichlorvos (organophosphate class of insecticide), propoxur (carbamate class), and resmethrin and two synergized pyrethrin products (pyrethroid class). The classes of insecticides reflect the different modes of action on the central nervous system of mosquitoes that cause lethality. All six products have been registered for ground-based applications but only malathion and propoxur have been registered for aerial application (from fixed or rotary-wing aircraft). The PMRA is presently close to completing its re-evaluation of malathion for adult mosquito control.

Whether delivered by ground or aerial means, Ultra Low Volume (ULV) fogging is generally recommended over thermal fogging because a lower volume of insecticide is used. ULV fogging uses a water-based carrier rather than oil-based (with thermal fogging) and application costs may be lower.

For more information about specific adulticides, please contact the Pest Management Regulatory Agency by phoning 1-800-267-6315 or via the Health Canada website at: www.hc-sc.gc.ca/pmra-arla/english/index-e.html.

Monitoring the Effectiveness of Vector Control Measures

Following larviciding or 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. Landing or biting counts of mosquitoes on human volunteers is another way of enumerating a relative reduction in mosquito exposure following control measures. Monitoring the frequency of local citizen complaints of mosquitoes or mosquito bites is less precise, and has been used as a more subjective method to evaluate nuisance control.

For larviciding, a more specific and immediate field evaluation of effectiveness 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. The general aim of larviciding is to obtain 95% control within 24 hours of application after all label directions have been followed.

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 effectiveness of the insecticiding, especially adulticide fogging. In addition, there may have been implementation errors or barriers, such as applicator errors, inadequate numbers of staff or application equipment, or improper calibration of the equipment.

Because the issue of how well a mosquito control 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 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 stated in Appendix 2.

Under the *Health Protection and Promotion Act*, O. Reg. 199/03, Health Units are 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 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. In order to assess the nature or likelihood of the exposure of the affected persons, 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.

RESEARCH AND EVALUATION

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.

Background
Given the large number of mosquitoes in the province of Ontario, it is necessary to monitor the success of the work being undertaken through larviciding in particular toward the reduction of the 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. Original research, as noted below, is also a component of the Ontario plan.

Planned Activity
- The MOHLTC shall weekly, and more frequently, if necessary, hold open communication with all Health Units through teleconference and e-mail to determine what is happening across the province and to share data, information of successes and of problems.

- The MOHLTC is working with McMaster University to conduct a WNv seroprevalence study. The purpose of the study is to estimate the seroprevalence of West Nile virus antibody amongst people living in southern Oakville during the summer of 2002. The study will also try to determine some of the risk factors for WNv infection and assess knowledge, beliefs, attitudes and factors associated with risk reduction behaviours in this population.

- The MOHLTC is supportive of the epidemiologic analysis of 2002 data as planned by the CCWHC in conjunction with Health Canada to evaluate the usefulness of a dead crow-sighting index as a predictor of WNv activity.

- The MOHLTC will be evaluating the information on WNv vectors at the local level. The assessment will evaluate whether such information on the viral status of mosquito pools provided a valuable component in the risk assessment or was value neutral. This information will contribute to determining the level of mosquito surveillance needed in subsequent years.