Field Safety Manual Appendix 3: Insects and Infectious Diseases.

In Manitoba and surrounding areas biting insects including mosquitos and ticks can be present and active from the time snow melts until the snow falls again. During that time they can be a source of a number of infectious agents (see table below). No matter what you may be exposed to, infection with these agents commonly start with non-specific flu like symptoms. If you work in an area where you are exposed to biting insects you should take these symptoms seriously and see your family doctor. Be sure to explain that you work in an area where you are potentially exposed to biting insects and the pathogens they carry. For more information regarding ticks and the diseases they carry refer to the attached Lyme disease pamphlet from The Public Health Agency of Canada and the Tickborne Diseases of the United States from the US Centre for Disease Control.

<table>
<thead>
<tr>
<th>Vector</th>
<th>Disease</th>
<th>Notations</th>
</tr>
</thead>
<tbody>
<tr>
<td>Culex tarsalis mosquito</td>
<td>West Nile Virus</td>
<td>Commonly infection is asymptomatic or causes flu like symptoms. Serious complications can occur. See attached Pathogen Safety Data Sheet</td>
</tr>
<tr>
<td>Blacklegged Tick</td>
<td>Lyme Disease (caused by Borrelia burgdorferi)</td>
<td>Important to treat early, can cause serious illness if infection is left long term. “Bullseye” rash may not always be present.</td>
</tr>
<tr>
<td>Blacklegged Tick</td>
<td>Anaplasmosis (caused by Anaplasma phagocytophilum)</td>
<td>Can cause severe illness.</td>
</tr>
<tr>
<td>Blacklegged Tick</td>
<td>Babesiosis (caused by Babesia microti)</td>
<td>Can be life threatening.</td>
</tr>
<tr>
<td>Blacklegged Tick</td>
<td>Powassan Virus</td>
<td>Can be life threatening.</td>
</tr>
<tr>
<td>Mosquito</td>
<td>Snowshoe hare virus (Ref 4)</td>
<td>Central nervous system infections</td>
</tr>
<tr>
<td>Mosquito</td>
<td>Cache Valley Virus (Ref 4)</td>
<td>Central nervous system infections</td>
</tr>
</tbody>
</table>

The following measures can help protect you against biting insects and the pathogens they carry.

**Protective Clothing**

Clothing that can be effective against biting insects are as follows:
- **Footwear** – Best protection against ticks living on the ground and in the grass is given by wearing high cut boots (calf length) constructed from slick materials which are difficult for ticks to grab ahold. Rubber boots are bust but leather boots are also effective for this purpose. Wearing full shoes can help prevent mosquitoes from biting you.
• Tuck pants into high cut boots – Tucking your pants into your boots prevents ticks from crawling up under your pant leg and exploring areas of your lower body. If you don’t have boots tuck your pant legs into your socks.

• Pants and full sleeved shirts – It is more difficult for biting insects to bite covered skin so cover your arms legs and torso. Tuck shirts into pants to make it harder for ticks to crawl under your shirt and exploring areas of your upper body.

• Hat – Wearing a hat can make it harder for ticks to crawl into your hair and latch onto your scalp. It offers the added benefit of protecting you from the sun.

• Light coloured clothing – Wear light coloured clothing to make it easier to spot dark coloured ticks and pick them off your clothing. Light coloured clothing will also make you less attractive to mosquitos.

**Insect Repellents**

**DEET**

This product is a repellent which is effective against ticks and mosquitos. It works by camouflaging humans from these biting insects. DEET interferes with neurons and receptors located on the mosquito’s antennae and mouth-parts that detect chemicals such as lactic acid and carbon dioxide (ref 1). When applied correctly, DEET forms a vapour barrier at the skin surface that deters mosquitoes from landing on the skin (ref 1). Concentrations up to 30% are readily available in Canada. The product can be applied to both clothing and skin. For tick protection apply DEET to clothing. Read and follow the instructions on packaging of the product used.

Conflicting information has been provided regarding the safety of DEET. For those concerned about direct exposure to this chemical applying it to clothing may be a more acceptable option.

**Icaridin/picaridin**

This product has levels of efficacy similar to DEET in preventing mosquito and tick bites. Although it is widely used in Europe and in the United States, this repellent was only licensed in Canada in 2012. Icaridin is considered to be the repellent of first choice by the Public Health Agency of Canada’s Canadian Advisory Committee on Tropical Medicine and Travel for travelers six months to 12 years of age. Products containing up to 20% icaridin are considered to be safe and efficacious. (ref 2)

**Natural Repellents**

These may include products like oil of lemon eucalyptus, soybean oil or citronella oil. They are typically effective for a shorter period of time as compared to Icaridin or DEET and may not protect against tick bites (ref 2).

**Permethrin**

This product is a mild repellent and contact insecticide which is not approved for use in Canada. Clothing pre-treated with permethrin and sprays for treating clothing with permethrin are available in America through online retailers and through a limited number of Canadian retailers. These products can be imported for personal use. Permethrin is designed for application to clothing only and must not be applied directly to skin. It is neurotoxic in insects causing muscle spasm, paralysis, and death (ref 3). Care must be taken if handling equine fly sprays which commonly contain permethrin. Wearing protective clothing treated with the insecticide permethrin in addition to using DEET or icaridin on exposed skin as a repellent may offer the most effective protection overall against mosquito and tick bites (ref 2).

References:


www.umanitoba.ca/campus/health_and_safety/)
Acknowledgement
This Appendix has been written with input and assistance from Dr. Kateryn Rochon in the Department of Entomology.
Why protect yourself from mosquito bites?

Summer’s here, and it is more important than ever to protect yourself from pesky mosquito bites. Not only are bites uncomfortable, but the mosquito that bites you may also give you West Nile virus.

What is West Nile virus?

West Nile virus is mainly transmitted to people through the bite of an infected mosquito. Most people infected with the virus have no symptoms or they have flu-like symptoms, such as fever, headache, body aches and fatigue. Sometimes though, the virus can cause severe illness, including meningitis and encephalitis.

The chances of getting West Nile virus from an infected mosquito are low. While anyone can become infected with West Nile virus, the risk of severe illness increases with age. Protect yourself and your family from mosquito bites!

How can you protect yourself and your family from mosquito bites and West Nile virus?

- Get rid of as much standing water as you can from around your home and property. Drain water from flower pots, wading pools, old tires and so on. Change water in birdbaths and pet bowls twice a week.
- Make sure your screens are in good repair.
- Why should you use insect repellent?
  Using insect repellent helps stop mosquito bites that may give you West Nile virus, so you and your family can continue to work and play outdoors with greater peace of mind.
- Is DEET safe?
  Yes. Insect repellents containing DEET are safe when used as directed. DEET has been safely used in North America for more than 40 years. Use only insect repellents that have a P.C.P. Act number on either the front or back of the bottle. This number means the product has been approved in Canada.
  - Always read and follow the directions on the insect repellent container, especially when using on young children.
  - Only a thin layer of repellent is needed. Apply to skin surfaces that are not covered by clothing. Repellents can also be applied to your clothing.
  - If you plan to be outdoors for a short period of time, choose a repellent with a lower concentration of DEET and reapply as needed.
  - Wash treated skin with soap and water when you return indoors or when you no longer need protection.
  - Do not put repellent on children’s faces and hands. This will reduce their chances of getting it in their eyes and mouths.
  - You can use both sunscreen and insect repellent when you are outdoors. Apply the sunscreen first, followed by the insect repellent.
- Is there a specific time of day when you should use insect repellent?
  Mosquitoes can bite anytime—day or night. Contact your local public health authority to find out when you are most at risk.

Directions for application:

- Do not use DEET on infants less than 6 months.
- For children 6 months to 2 years, use only if there is a high risk for mosquito bites, and then use only once a day (use product containing 10% DEET or less).
- For children 2-12 years, use no more than 3 times a day (10% DEET or less). Avoid using over a long period.
- For adults and children over 12 years, Health Canada recommends insect repellents containing 5-30% DEET.
- Do not use repellent on open wounds or on skin that is sore or sunburned.
- Do not put on repellent unless you are going outdoors.

This information is brought to you by the Public Health Agency of Canada with the collaboration of your local retailers.

To find more detailed information on West Nile virus or to link to your provincial or territorial government Web sites, visit the Public Health Agency of Canada’s West Nile virus Web site at: www.westnilevirus.gc.ca.

To receive more information on West Nile virus or to find the number of your local public health authority, call: 1 800 816-7292 (toll-free).
Pourquoi vous protéger contre les piqûres de moustiques ?

L'été est arrivé et, plus que jamais, il est important de vous protéger contre les fichues piqûres de moustiques. Non seulement les piqûres sont inconfortables, mais le moustique qui vous pique peut aussi vous transmettre le virus du Nil occidental.

Qu'est-ce que le virus du Nil occidental ?

Le virus est principalement transmis aux êtres humains par une piqûre de moustique infecté. La plupart des personnes infectées par le virus ne présentent aucun symptôme ou ont des symptômes qui ressemblent à ceux de la grippe, comme de la fièvre, des maux de tête, des courbatures et de la fatigue. Toutefois, le virus peut parfois entraîner des maladies graves incluant la méningite et l’encéphalite.

Les risques de contracter le virus du Nil par une piqûre de moustique infecté sont peu élevés. Quoique chacun court le risque de devenir infecté par le virus du Nil occidental, les risques d’être atteint d’une maladie grave augmentent avec l’âge. Protégez-vous donc, vous et votre famille, contre les piqûres de moustiques !

Comment vous protéger contre les piqûres de moustiques et le virus du Nil occidental ?

- Choisissez un insectifuge qui contient du DEET ou d’autres ingrédients autorisés.
- Portez des vêtements de couleurs claires, un haut à manches longues, un pantalon long et un chapeau quand vous êtes à l’extérieur et que les moustiques sont plus actifs.
- Assurez-vous que vos moustiquaires sont en bon état.
- Lavez les parties du corps traitées avec du savon et de l’eau lorsque vous rentrez à l’intérieur ou lorsque vous n’avez plus besoin de protection.
- N’appliquez pas d’insectifuge sur le visage ou les mains ou le corps des enfants de moins de 6 mois.
- N’utilisez pas d’insectifuge sur le visage ou les mains ou le corps des enfants de 6 mois à 2 ans, les adultes et les enfants de plus de 12 ans, Santé Canada recommande d’utiliser des insectifuges dont la concentration en DEET se situe entre 5 % et 30 %.
- Lisez et suivez toujours les directives sur le contenant, particulièrement lorsque vous utilisez le produit sur de jeunes enfants.
- Si vous comptez être à l’extérieur pendant une courte période de temps, choisissez un insectifuge à plus faible concentration en DEET et appliquez-en de nouveau, au besoin.
- Lavez les parties du corps traitées avec du savon et de l’eau lorsque vous rentrez à l’intérieur ou lorsque vous n’avez plus besoin de protection.
- N’appliquez pas d’insectifuge sur le visage ou les mains des enfants. Cette mesure réduira les risques de contact du produit avec leurs yeux et avec leur bouche.
- Lorsque vous êtes à l’extérieur, vous pouvez utiliser à la fois un écran solaire et un insectifuge. Appliquez d’abord l’écran solaire et ensuite l’insectifuge.
- Pour les enfants de 2 à 12 ans, appliquez un insectifuge dont la concentration est d’au plus 10 %, mais pas plus de 3 fois par jour. Évitez d’utiliser le produit sur une longue période.
- Pour les garçons et les filles de moins de 6 mois, utilisez un insectifuge dont la concentration est d’au plus 10 %.
- Pour les garçons et les filles de plus de 6 mois à 2 ans, appliquez un insectifuge dont la concentration est d’au plus 10 %, mais pas plus de 3 fois par jour. Évitez d’utiliser le produit sur une longue période.
- Pour les enfants de 2 à 12 ans, appliquez un insectifuge dont la concentration est d’au plus 10 %, mais pas plus de 3 fois par jour. Évitez d’utiliser le produit sur une longue période.
- Pour les adultes et les enfants de plus de 12 ans, Santé Canada recommande d’utiliser des insectifuges dont la concentration en DEET se situe entre 5 % et 30 %.
- N’utilisez pas d’insectifuge sur des blessures ouvertes ou sur une peau irritée ou ayant subi un coup de soleil.
- Appliquez un insectifuge seulement si vous allez à l’extérieur.

Mode d’application :

N’utilisez pas de produits contenant du DEET pour des enfants de moins de 6 mois.

Pour les enfants de 6 mois à 2 ans, utilisez le produit seulement si les risques de piqûres de moustiques sont élevés, et seulement une fois par jour (utilisez un produit dont la concentration en DEET est d’au plus 10 %).

Pour les enfants de 2 à 12 ans, appliquez un insectifuge dont la concentration est d’au plus 10 %, mais pas plus de 3 fois par jour. Évitez d’utiliser le produit sur une longue période.

Pour obtenir des renseignements supplémentaires sur le virus du Nil occidental, visitez le site Web de votre province ou territoire, ou appelez le 1-866-668-7292.
Take a few minutes to inform yourself about the potential risks and the simple ways you can protect your family from tick bites, infection, and the long-term effects of Lyme disease.

WHAT IS LYME DISEASE?

Lyme disease is the most common disease spread by ticks in Canada, caused by the bite of infected blacklegged ticks. Lyme disease can have serious symptoms but it can be treated effectively if caught early.

While not all blacklegged ticks carry Lyme disease, populations of infected blacklegged ticks are growing. This means that the risk of contracting Lyme disease is on the rise across Canada. Take steps to reduce your risk if you spend time outdoors in areas where there may be ticks.

Ticks can be as small as a poppy seed and their bites are usually painless, so you may not know you’ve been bitten. That’s why it’s important to be on the lookout for ticks and the symptoms of Lyme disease.

C An what is Lyme disease? My pet get or spread Lyme disease?

Although pets, particularly dogs, can contract Lyme disease, there is no evidence that they can spread the infection directly to people. Pets can, however, carry infected ticks into homes and yards. Like people, the best protection for your pets is to avoid Lyme-infected tick bites. If possible, keep pets out of the woods and do regular tick checks.

The most common symptom of Lyme disease in pets is arthritic pain, with some having fatigue and fever. Contact your veterinarian if you suspect your pet may have Lyme disease or to discuss appropriate measures to protect your pet.

For more information on how to prevent, recognize and take action on Lyme disease, visit: Canada.ca/LymeDisease

PROTECT YOURSELF, YOUR FAMILY, AND YOUR PETS FROM LYME DISEASE

Lyme disease is a serious illness that is spread by the bite of infected blacklegged ticks, found most often near wooded areas in Canada’s southern regions. It can have severe symptoms, but it’s also easy to prevent and treat when caught early.

Don’t let a SMALL PEST turn into a BIG PROBLEM

Lyme disease is on the rise in Canada. Prevention is easier than you think.
WHERE ARE TICKS FOUND?
Blacklegged ticks are most often found in forests and the overgrown areas between the woods and open spaces, although it is possible to be bitten outside of these areas.

The Public Health Agency of Canada works with provincial and territorial health authorities to identify where populations of infected blacklegged ticks have been established or are spreading. The following are areas where blacklegged tick populations have been confirmed or are establishing:
- Southern British Columbia
- Southeastern and south-central Manitoba
- Southern and eastern Ontario
- Southern Quebec
- Southern New Brunswick and Grand Manan Island
- South shore and northern mainland Nova Scotia

Surveillance is ongoing to confirm other areas of spread. Visit Canada.ca/LymeDisease for the most up-to-date information.

Ticks don’t move far by themselves but they can attach to migratory birds, and may fall off far from their original location. For this reason, it is possible to find infected ticks in other areas than the ones listed above.

HOW CAN YOU AVOID TICK BITES?
The best way to prevent Lyme disease is to prevent tick bites. Here are some ways to protect yourself if you venture into forests or overgrown areas between the woods and open spaces:
- Wear closed-toe shoes, long-sleeved shirts and pants.
- Pull your socks over your pant legs to prevent ticks from crawling up your legs.
- Wear light-coloured clothes to spot ticks easier.
- Use bug spray containing DEET or Icaridin on your skin and clothing.
- Shower or bathe within two hours of being outdoors to wash away loose ticks.
- Do daily “full body” check for ticks on yourself, your children and your pets.

Ticks can be infected with more than one type of bacteria that can cause human illness. Guarding against tick bites will protect you from more than just Lyme disease.

WHAT SHOULD YOU DO IF YOU GET BITTEN?
Removing ticks within 24-36 hours usually prevents infection. Using clean tweezers, grasp the head as close to the skin as possible and pull slowly straight out. Afterwards, wash the bite with soap and water or disinfect with alcohol or hand sanitizer. If mouthparts break off and remain in the skin, remove them with tweezers or, if you are unable to remove them easily, leave them alone and let the skin heal. If possible, save the tick that bit you in a zip-lock bag and record the date of the bite.

If you develop symptoms of Lyme disease in the weeks after you are bitten, contact your health care provider right away. If you have saved the tick, bring it to your medical appointment as it may help the doctor in their assessment of your illness.

WHAT ARE THE SYMPTOMS OF LYME DISEASE?
Initial symptoms differ from person to person, which makes Lyme disease very difficult to diagnose. Some will experience mild symptoms like fever or a skin rash soon after being bitten, while others may suffer severe symptoms, but not for weeks after the bite.

Signs and symptoms of Lyme disease can include one or a combination of the following with varying degrees of severity:
- Fatigue
- Fever or chills
- Headache
- Muscle and joint pain, spasms, or weakness
- Numbness or tingling
- Swollen lymph nodes
- Skin rash
- Cognitive dysfunction, dizziness
- Nervous system disorders
- Arthritis and arthritic symptoms
- Heart palpitations

Untreated, symptoms can last years and include recurring arthritis and neurological problems, numbness and paralysis. Although not common, fatalities from Lyme disease have been reported.

HOW IS LYME DISEASE DIAGNOSED?
Diagnosing Lyme disease can be difficult as symptoms vary from one person to another, and can be similar to other infectious diseases that are spread by ticks. The earlier you receive a diagnosis, the greater the chances of a successful treatment. As such, it is important to consult a health care professional as early as possible if you have symptoms or if you feel unwell in the weeks following a tick bite. Your healthcare provider will likely:
- Examine your symptoms
- Determine if you were potentially exposed to Lyme-infected blacklegged ticks by asking about your recent activities
- If necessary, laboratory blood testing can be used to further support a clinical diagnosis

WHAT IS THE TREATMENT FOR LYME DISEASE?
Lyme disease can be effectively treated with 2 to 4 weeks of antibiotics. Depending on your symptoms, and if you are diagnosed in the later stages of the disease, you may require a longer course of antibiotics.

Some people experience symptoms that continue more than 6 months after treatment. Research continues into the causes of these persistent symptoms and methods of treatment.

For more information and helpful tips, visit: Canada.ca/LymeDisease
Pathogen Safety Data Sheets: Infectious Substances – West Nile virus (WNV)

PATHOGEN SAFETY DATA SHEET - INFECTIOUS SUBSTANCES

SECTION I - INFECTIOUS AGENT

NAME: West Nile virus (WNV)

SYNONYM OR CROSS REFERENCE: WNV, West Nile virus, West Nile fever, West Nile encephalitis, WN (West Nile) fever, West Nile disease, and West Nile neuroinvasive disease.

CHARACTERISTICS: A member of the genus Flavivirus, and Flaviviridae family. West Nile virus is an icosahedral, enveloped virus of 40 to 50 nm in diameter and has a single-stranded, positive-sense RNA (Ribonucleic acid) genome. WNV (West Nile virus) belongs to the Japanese encephalitis antigenic complex.

SECTION II - HAZARD IDENTIFICATION

PATHOGENICITY/TOXICITY: Most individuals infected with WNV, West Nile virus remain asymptomatic. West Nile (WN) fever is typically a mild illness lasting 3 to 6 days. The main symptoms are sudden onset of fever with chills, rash, malaise, headache, backache, arthralgia, myalgia and eye pain. Other non-specific manifestations include nausea, vomiting, anorexia, diarrhoea, rhinorrhea, sore throat, and cough. In some patients there is generalised lymphadenopathy, and an erythematous macular, papular, or morbilliform eruption involving the entire body.
Meningitis, encephalitis, and/or acute flaccid paralysis develop in less than 1% of WNV (West Nile virus)-infected individuals\(^2\). Patients with neurological disease typically have a febrile prodrome of 1 to 7 days, which may be biphasic, before they develop neurological symptoms\(^1\). Typically, neurological patients will present with a fever, stiff neck, headache, weak muscles, gastrointestinal symptoms, disorientation, tremors, convulsions, and paralysis\(^1,4,10\).

A New York serological survey revealed that, of those infected, approximately 20% developed West Nile fever\(^14\). The overall case fatality rate ranges from 4% to 14% in individuals exhibiting neuroinvasive disease, with a higher incidence of severe presentation and higher fatality rates in older populations\(^2,14\).

**EPIDEMIOLOGY:** WNV was first discovered in 1937 from the blood of a febrile woman in the West Nile region of Uganda\(^5,9,10\). WNV is now known to be enzootic in most of Africa, southern Europe, India, the Middle East, western and southeast Asia, Australia (known as Kunjin virus), and North America\(^1,8,9,15\). WNV was first detected in North America in 1999, following an outbreak in New York City\(^8\). The virus spread westwards across the United States, southward into Central America and the Caribbean, and northward into Canada\(^8,10,11\), resulting in the largest epidemics of neuroinvasive WNV fever ever known\(^8,10\). In temperate and subtropical regions, most infections in humans occur in summer or early fall when; whereas, infections in tropical regions tend to coincide with the rainy season when mosquito populations are most abundant\(^16\).

**HOST RANGE:** Humans\(^1,2,3,4,5,6,7,8,9,10,11,12,13,17\), mosquitoes\(^1,3,4,5,6,7,8,9,10,12\), ticks\(^7,8\), birds (particularly passerine species)\(^1,3,5,6,8,9,17\), horses\(^1,6\), alligators (Alligator mississippiensis)\(^6\), tree squirrels (Sciurus spp.)\(^3\), eastern chipmunks (Tamias striatus), eastern cottontail rabbits (Sylvilagus floridanus), lake frogs (Rana ridibunda); as well as a broad range of common North American wild and domestic mammals, such as dogs, deer, feral swine, coyotes, foxes, opossums, raccoons skunks, bats and other small rodents.

**INFECTION DOSE:** One viral unit (via the intramuscular route)\(^18\).

**MODE OF TRANSMISSION:** The main route of infection is via the bite of a mosquito that has been infected by feeding on WNV (West Nile virus) infected birds\(^1,3,6,9\). Humans and most other mammals are regarded as dead-end hosts, since they do not produce sufficient viraemia to infect mosquitoes and thus do not significantly contribute to the transmission cycle\(^10,12\).

Other possible routes include blood transfusion, vertical transmission, breast milk, organ transplantation\(^11\), contact of the conjunctiva with contaminated bodily secretions of infected birds\(^17\), and laboratory accidents involving injury with sharps\(^13\).

**INCUBATION PERIOD:** Ranges from 2 to 6 days, but may extend to 14 days, or as long as 21 days for patients following organ transplantation\(^1,14\).
COMMUNICABILITY: Human-to-human transmission can occur via infected breast milk, organ transplantation, blood transfusion, and via vertical transmission (from mother to child during pregnancy)\(^{(11)}\).

SECTION III - DISSEMINATION

RESERVOIR: Birds, particularly passerine species (jays, finches, grackles, sparrows, and crows)\(^{(3, 6, 11)}\).

ZOONOSIS: Yes. Humans can contract \textit{WNV} (\textit{West Nile virus}) from the exposure of conjunctival membranes\(^{(17)}\) and/or percutaneous injury to the body fluids or tissues of \textit{WNV} (\textit{West Nile virus}) infected birds\(^{(13)}\), as well as indirectly by the bite of an infected mosquito\(^{(4, 15, 16)}\).

VECTORS: The main vectors are \textit{Culex} mosquitoes\(^{(1, 3, 4, 9, 10)}\).

In North America: \textit{C. pipiens}, \textit{C. restuans}, \textit{C. salinarius}, \textit{C. quinquefasciatus}, and \textit{C. tarsalis}\(^{(3, 9, 10)}\).

In Africa and the Middle East: \textit{C. univittatus}\(^{(5, 9)}\).

In Asia: \textit{C. vishnui}\(^{(6)}\).

In Europe: \textit{C. pipiens}, \textit{C. modestus}, and \textit{Coquillettidia richardi}\(^{(9)}\).

Other mosquito species such as \textit{Culex nigripalpus}, \textit{Aedes albopictus}, \textit{Aedes vexans}, and \textit{Ochlerotatus triseriatus}, may also be of importance in the transmission of \textit{WNV} (\textit{West Nile virus})\(^{(3)}\).

SECTION IV - STABILITY AND VIABILITY

DRUG SUSCEPTIBILITY: Ribavirin and interferon can inhibit \textit{WNV} (\textit{West Nile virus}) \textit{in vitro}\(^{(10, 11)}\).

SUSCEPTIBILITY TO DISINFECTANTS: Susceptible to disinfectants such as 3 to 8\% formaldehyde, 2\% glutaraldehyde, 2 to 3\% hydrogen peroxide, 500 to 5,000 ppm (Parts per million) available chlorine, alcohol, 1\% iodine, and phenol iodophors\(^{(19)}\).

PHYSICAL INACTIVATION: Inactivated by heat (50 to 60\(^\circ\)C for at least 30 minutes), ultraviolet light, and gamma irradiation\(^{(19)}\).

SURVIVAL OUTSIDE HOST: Low temperatures preserve infectivity, with stability being greatest below -60\(^\circ\)C\(^{(19)}\). When added to ELISA (Enzyme-linked immunosorbent assays) wash buffer there is a 10-fold decrease in titre per 24 hour period at 28\(^\circ\)C\(^{(20)}\).

SECTION V - FIRST AID / MEDICAL
SURVEILLANCE: Monitor for symptoms. Confirmation is via virus isolation from blood\(^1\) or cerebrospinal fluid\(^{1,2,10,11}\) during the viraemic phase. Other methods of detection include PCR (Polymerase chain reaction)\(^{2,3,4,13,18}\), haemagglutinin inhibition\(^{1,12,17}\), plaque reduction neutralization\(^{1,12}\), compliment fixation, indirect immunofluorescence assay\(^{12}\), and IgM (Immunoglobulin M) capture ELISA (Enzyme-linked immunosorbent assays)\(^{1,2,3,10,12,17}\).

Note: All diagnostic methods are not necessarily available in all countries.

FIRST AID/TREATMENT: Currently there is no treatment of proven efficacy for WNV (West Nile virus) fever\(^{10,11}\). Supportive therapy for encephalitis cases includes intravenous fluid, electrolyte management, assisted respiration if needed, anticonvulsants, management of cerebral oedema, and prevention of secondary bacterial infections\(^{1,2}\). Studies have assessed ribavirin, interferon, osmotic agents, gamma globulins, and steroids for treatment of WN fever in open trials, but more definitive evidence is needed to determine their efficacy\(^{1,2,4}\).

IMMUNIZATION: None currently available. An inactivated vaccine is available for horses, but human vaccines are unlikely to be available for several years\(^{4,12}\), although a number of candidates are in clinical trials\(^{10,12}\).

PROPHYLAXIS: None currently available. The most effective preventative measure it to avoid mosquito bites\(^{2,3,4,6,10}\). There are no chemoprophylactic measures for individuals suspected of being in contact with WNV (West Nile virus). To prevent transmission of WNV (West Nile virus) through blood transfusion and organ donations, blood products are screened for WNV (West Nile virus) in the United States\(^{11}\).

SECTION VI - LABORATORY HAZARDS

LABORATORY-ACQUIRED INFECTIONS: Eighteen cases were reported up until 1980\(^{21}\), with no deaths. Recently two more cases were reported of workers who acquired WNV (West Nile virus) following percutaneous inoculation whilst handling fluids and tissues infected with WNV (West Nile virus)\(^{13}\).

SOURCES/SPECIMENS: Blood\(^{2,3,10,12}\), cerebrospinal fluid\(^{1,2,3,10,11,12}\), tissues\(^{2,3,11,12,17}\), infected arthropods\(^{1,2,3,4,5,6,7,8,9,10,11,12,13}\), oral and cloacal swabs, and feather pulp\(^3\).

PRIMARY HAZARDS: Needlestick injuries, droplets, and aerosols\(^{6,13,17}\).

SPECIAL HAZARDS: Faecal secretions of infected birds may present a hazard to humans\(^{4,17}\).

SECTION VII - EXPOSURE CONTROLS / PERSONAL PROTECTION
RISK GROUP CLASSIFICATION: Risk Group 3\(^{(22)}\).

CONTAINMENT REQUIREMENTS: Containment Level 3 facilities, equipment, and operational practices for work involving infectious or potentially infectious materials, animals, or cultures.

PROTECTIVE CLOTHING: Personnel entering the laboratory should remove street clothing and jewellery, and change into dedicated laboratory clothing and shoes, or don full coverage protective clothing (i.e., completely covering all street clothing). Additional protection may be worn over laboratory clothing when infectious materials are directly handled, such as solid-front gowns with tight fitting wrists, gloves, and respiratory protection. Eye protection must be used where there is a known or potential risk to splashes\(^{(23)}\).

OTHER PRECAUTIONS: All activities with infectious material should be conducted in a biological safety cabinet (BSC) or other appropriate primary containment device in combination with personal protective equipment. Centrifugation of infected materials must be carried out in closed containers placed in sealed safety cups, or in rotors that are unloaded in a biological safety cabinet. The use of needles, syringes, and other sharp objects should be strictly limited. Open wounds, cuts, scratches, and grazes should be covered with waterproof dressings. The use of needles, syringes and other sharp objects should be strictly limited. Additional precautions should be considered with work involving animals or large scale activities\(^{(23)}\).

SECTION VIII - HANDLING AND STORAGE

SPILLS: Allow aerosols to settle and, wearing protective clothing, gently cover spill with paper towels and apply appropriate disinfectant, starting at the perimeter and working towards the centre. Allow sufficient contact time before clean up (30 min).

DISPOSAL: Decontaminate all materials for disposal by steam sterilisation, chemical disinfection, and/or incineration\(^{(23)}\).

STORAGE: In sealed, leak-proof containers that are appropriately labelled and locked in a Containment Level 3 laboratory\(^{(23)}\).

SECTION IX - REGULATORY AND OTHER INFORMATION

REGULATORY INFORMATION: The import, transport, and use of pathogens in Canada is regulated under many regulatory bodies, including the Public Health Agency of Canada, Health Canada, Canadian Food Inspection Agency, Environment Canada, and Transport Canada. Users are responsible for ensuring they are compliant with all relevant acts, regulations, guidelines, and standards.

UPDATED: September 2010.

PREPARED BY: Pathogen Regulation Directorate, Public Health Agency of Canada.
Although the information, opinions and recommendations contained in this Pathogen Safety Data Sheet are compiled from sources believed to be reliable, we accept no responsibility for the accuracy, sufficiency, or reliability or for any loss or injury resulting from the use of the information. Newly discovered hazards are frequent and this information may not be completely up to date.

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REFERENCES:


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2018-06-13
Pathogen Safety Data Sheets: Infectious Substances – Borrelia burgdorferi

MATERIAL SAFETY DATA SHEET - INFECTIOUS SUBSTANCES

SECTION I - INFECTIOUS AGENT

NAME: Borrelia burgdorferi

SYNONYM OR CROSS REFERENCE: Lyme disease, Lyme borreliosis, relapsing fever, Erythema migrans (EM) with polyarthritis, Lyme arthritis, Tickborne meningopolyneuritis

CHARACTERISTICS: Spirochete, first identified in 1982

SECTION II - HEALTH HAZARD

PATHOGENICITY: Tickborne zoonotic disease characterized by distinctive skin lesion (EM, a red macule or papule that expands in an annular manner), systemic symptoms, polyarthritis, and neurologic and cardiac involvement; malaise, fatigue, fever, headache, stiff neck, myalgia, migratory arthralgias or lymphadenopathy lasting several weeks and may precede lesions; neurological and cardiac abnormalities weeks to months after onset of EM; chronic arthritis may develop

EPIDEMIOLOGY: In USA, endemic foci along east coast, Wisconsin, Minnesota, California and Oregon; One endemic area in Southern Ontario; Europe, Soviet Union and independent states, Australia, China and Japan; cases occur primarily during summer; distribution coincides with abundance of relevant ticks

HOST RANGE: Humans, deer, wild rodents
INFECTIONOUS DOSE: Unknown

MODE OF TRANSMISSION: By exposure to an infected tick

INCUBATION PERIOD: From 3-32 days after tick exposure

COMMUNICABILITY: No evidence of natural transmission from person to person

SECTION III - DISSEMINATION

RESERVOIR: Deer, wild rodents (mice), ticks through transstadial transmission

ZOOONOSIS: Yes - bite of tick from an infected animal

VECTORS: Ticks - *Ixodes scapularis* (formerly *Ixodes dammini*) - eastern and midwestern USA

*Ixodes pacificus* (western USA)

*Ixodes ricinus* (Europe)

*Ixodes persulcatus* (Asia)

SECTION IV - VIABILITY

DRUG SUSCEPTIBILITY: Sensitive to doxycycline (adults) and amoxicillin (adults and children < 9 years); erythromycin for those allergic to penicillins or tetracyclines

SUSCEPTIBILITY TO DISINFECTANTS: Susceptible to 1% sodium hypochlorite and 70% ethanol

PHYSICAL INACTIVATION: Sensitive to heat, UV

SURVIVAL OUTSIDE HOST: Infected guinea pig blood - 28 to 35 days at room temperature; survives for short periods in urine; can survive up to 48 days at 4°C in human blood processed for transfusion

SECTION V - MEDICAL
SURVEILLANCE: Monitor for appearance of typical lesions; serological tests (IFA, ELISA) show a rise in antibodies directed against the spirochete

FIRST AID/TREATMENT: Treatment of EM stage with doxycycline for adults and amoxicillin for children may prevent or lessen the severity of the major late cardiac, neurologic or arthritic complications

IMMUNIZATION: Newly developed recombinant outer-surface protein A vaccine (LYMErixT, SmithKline Beecham Biologicals) became licensed for use in the United States in December 1998

PROPHYLAXIS: Not generally warranted for a tick bite alone

SECTION VI - LABORATORY HAZARDS

LABORATORY-ACQUIRED INFECTIONS: None reported specifically for B. burgdorferi, however there have been 45 reported cases up to 1976 with 2 deaths for B. recurrentis and B. duttoni

SOURCES/SPECIMENS: Clinical specimens - blood, cerebrospinal fluid, urine, skin scrapings, retinal and synovial specimens; naturally or experimentally infected mammals, their ectoparasites and their infected tissues

PRIMARY HAZARDS: Accidental parenteral inoculation and exposure to infectious aerosols

SPECIAL HAZARDS: Ectoparasites (ticks) on laboratory animals

SECTION VII - RECOMMENDED PRECAUTIONS

CONTAINMENT REQUIREMENTS: Biosafety Level 2 practices, containment equipment and facilities for activities involving known or potentially infectious materials, including necropsy of infected animals

PROTECTIVE CLOTHING: Laboratory coat; gloves should be worn during necropsy of infected animals and when contact with infectious materials is unavoidable

OTHER PRECAUTIONS: None

SECTION VIII - HANDLING INFORMATION
SPILLS: Allow aerosols to settle; wearing protective clothing, gently cover spill with paper towels and apply 1% sodium hypochlorite, starting at perimeter and working way towards the centre of the spill; allow sufficient contact time (30 min) before clean up

DISPOSAL: Decontaminate before disposal - steam sterilization, chemical disinfection, incineration

STORAGE: In sealed containers that are appropriately labelled

SECTION IX - MISCELLANEOUS INFORMATION

Date prepared: November 1999

Prepared by: Office of Laboratory Security, PHAC

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